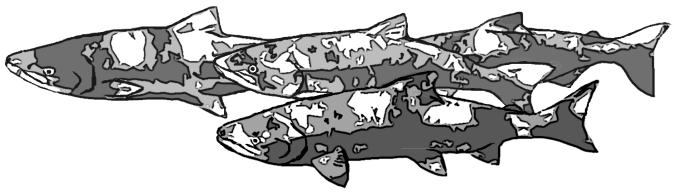
Part Four Summary of Plan Elements



4.1 Introduction

This part of the Summer Chum Salmon Conservation Initiative provides a summary description of the plan elements, considering how they apply across the Hood Canal/Strait of Juan de Fuca summer chum region and to individual summer chum salmon stocks and watersheds. The intent is to show what and where specific objectives, strategies and actions are to be applied, and by whom, to meet the plan's goal of protecting and restoring the summer chum runs. In the course of summarizing information below, references are given to specific sections of this plan where more complete and detailed information exists. Part Four also provides discussions of how the goals of the recovery plan and ESA will be achieved, when population-based recovery goals will be available, and how the plan will be implemented by the co-managers and others.

4.2 Summary of Plan Objectives, Strategies, and Actions

The objectives, strategies and actions of the plan are summarized in Tables 4.1 through 4.7. These applications are applicable to all of the summer chum watersheds and estuaries. Specific objectives are described within section dealing with Artificial Production, Ecological Interactions, Harvest Management, Habitat, Monitoring and Evaluation, and Program Integration and Adaptive Management. For each objective, one or more actions/strategies are described, including the participants with jurisdiction/authority, additional partners, status of available resources/funding, and time frame.

Actions are differentiated from strategies in that an action is a specific measure or set of measures that directly addresses a problem, and is agreed to by the parties with jurisdiction. A strategy is meant to be an approach to developing specific actions. In this plan, a strategy is generally indicated where not all participants with jurisdiction/authority are yet involved; the idea being that specific actions can be developed from the strategy once all the appropriate parties are participating (e.g., with regard to habitat issues).

Parties with jurisdiction/authority pertaining to a given action or strategy and other partners are listed in describing the action/strategy even if they are not yet participating in this plan. The intent is to

recognize the potential role of those parties and recommend their participation. But, of course, they are not necessarily bound by provisions set forth in this initiative.

The status of resources/funding to address a strategy or action is described in two categories, Phases 1 and 2. Phase 1 means the resources and funding required for the strategy or action are currently available. Phase 2 means the resources/funding are not currently available and, in some cases, may not yet be clearly identified.

The description of the time frame for an action/strategy is in general terms. Words such as continuing, immediate and undetermined are most often used to indicate the approximate timing for implementation. More specific information is provided when available.

4.2.1 Artificial Production

The artificial production program supplements production of severely depressed, at risk populations and reintroduces summer chum to watersheds where the historical populations have been lost. In the future, the program may also incorporate provisions for enhancing fishing opportunity. The program is coordinated with other management actions and is designed to minimize ecological and genetic risks. The program includes risk assessment leading to selection of projects, guidelines for effective and low risk operations, monitoring of implementation and success, and adaptive management (see Part Three, section 3.2). The following table summarizes the major actions of the co-managers under Artificial Production. Note that monitoring and evaluation measures are summarized separately below (see section 4.2.5).

Table 4.1 Artificial Production objectives and action items.

Objective: Conduct an annual evaluation of the risk of extinction for each extant summer chum stock.

Action Items	Description	Jurisdiction/ Authority	Partners	Resources/Funding	Time Frame
1. Update the plan's extinction risk evaluation with each year's escapement numbers.	See Part One, 1.7.4 - Stock Extinction Risk for discussion of assessment of extinction risk used in this recovery plan. The methodology (following Allendorf et al. (1997) uses recent population size and population trends to determine the risk of extinction for individual stocks.	WDFW, Tribes	NMFS, USFWS	Phase 1	Annual
2. Continually review literature for improved methods for extinction risk assessment	The science of risk assessment is rapidly evolving, and the co-manager's intent is to use the most current assessment techniques as they become available.	WDFW, Tribes	NMFS, USFWS	Phase 1	Annual
Objective: Avoid the future extinction of any extant summer chum stock through the use of supplementation techniques.					
1. Continue the current supplementation projects for summer chum salmon.	Continuing projects include Big Quilcene, Salmon Creek, Lilliwaup and Hamma Hamma.	WDFW, Tribes, USFWS	HCSEG, NOSC, WOS, LLTK	Generally, existing projects fall within the category of Phase 1 projects. New projects and some identified monitoring and assessment needs for existing projects (section 4.2.5) fall within the category of Phase 2 projects.	Several projects are currently in operation and are expected to continue under a defined schedule (section 3.2.3.4). One new project is recommended for Jimmycomelately stock (section 3.2.3.3) where project implementation is expected to begin the summer of 1999. Additional projects may be considered in the future (section 3.2.3.3).

Table 4.1 Artificial Production objectives and action items (continued).

Action Items	Description	Jurisdiction/ Authority	Partners	Resources/ Funding	Time Frame
2. Initiate a new supplementation project for the Jimmy-comelately stock.	The Jimmycomelately stock has been identified in this plan as having a high risk of extinction, because of current low population size and a recent precipitous decline (see Part One, 1.7.4 - Stock Extinction Risk). Efforts are underway to improve habitat conditions in the stream, however, these remedies are long term. Immediate supplementation is recommended, and is expected to commence in the summer of 1999.	WDFW, Tribes	NOSC and/or WOS	Phase 1	Immediate
3. Operate all supplementa-tion projects to minimize potential deleterious effect.	All supplementation projects will follow the recovery plan criteria for minimizing potential deleterious effects in the following areas: partial/ total hatchery failure, predation, competition, disease, and loss of genetic variability within and between populations.	WDFW, Tribes, USFWS	HCSEG, NOSC, WOS, LLTK	Phase 1	Immediate.
4. Initiate future supplementa-tion projects for any stock found to have a high risk of extinction.	Supplementation techniques to be used if assessment shows that the stock is in jeopardy of extinction and there are no other timely remedies.	WDFW, Tribes	Partners depend on stock location and interest of agencies and citizen groups	Phase 2	As needed.
Objective: Reintroduce summer chum salmon to region streams as donor stocks become available.					
1. Continue the current reintroduction projects for summer chum salmon.	Big Beef Chimacum	WDFW, Tribes, USFWS	HCSEG, NOSC, WOS, LLTK	Phase 1	Immediate.
2. Operate all reintroduction projects to minimize potential deleterious effect.	All supplementation projects will follow the recovery plan criteria for minimizing potential deleterious effects in the following areas: partial/ total hatchery failure, predation, competition, disease, and loss of genetic variability within and between populations.	WDFW, Tribes, USFWS	HCSEG, NOSC, WOS, LLTK	Phase 1	Immediate.

Table 4.1 Artificial Production objectives and action items (continued).

Action Items	Description	Jurisdiction/ Authority	Partners	Resources/ Funding	Time Frame
3. Initiate future reintroduction projects as donor stocks become available.	Stocks that are candidates for future reintroduction include: Tahuya Dewatto, Skokomish, and Anderson. Decisions to pursue reintroductions will be based on current status of donor stock (ability to contribute brood stock). Donor stocks will be limited to adjacent stocks not previously introduced to another streams.	WDFW, Tribes.	Partners depend on stock location and interest of agencies and citizen groups.	Phase 2	When appropriate.
4. Allow opportunity for natural reintroductions to occur on some streams through straying.	See Part One -1.7.2.3 for list of streams identified as possibly being part of the historic distribution of summer chum salmon. These streams will be allowed to repopulate naturally.	WDFW, Tribes.		Phase 1	Immediate

4.2.2 Ecological Interactions

Ecological interactions between summer chum and other species have been assessed as part of this initiative (see Part Three, section 3.3). There is little likelihood that summer chum (specifically, artificially produced summer chum) will substantially impact other species. The artificial production levels are relatively small, limiting competitive interactions with other juvenile salmonids, and since the production programs are intended to restore summer chum spawners to historical levels, competition on the spawning grounds should not be an issue. Because summer chum are released at a relatively small size, predation effects on other fishes is not a concern. More important to consider are the impacts of other species on summer chum. Primary sources of potential impact are other salmonids and marine mammals (see Part Two - Region-wide Factors for Decline). Potential impacts of other salmonids (with emphasis on hatchery produced fish) include effects from hatchery operations, predation, competition and fish disease transfer. The potential impact of marine mammals is predation on summer chum. Following are descriptions of actions to address these potential impacts.

Table 4.2 Ecological Interactions objectives and action items.

Objective: Eliminate and reduce negative hatchery interactions with summer chum.

Action Items	Description	Jurisdiction/ Authority	Partners	Resources/ Funding	Time Frame
1. Assess risks to summer chum from producing hatchery salmonids.	See Part Three, 3.3 for description of risk assessment that includes hazards from hatchery operations (associated with broodstock collection, water withdrawal, hatchery intakes and outlets, and pollution), predation (direct and indirect effects), competition and behavioral modification (from juvenile and adult hatchery fish), and fish disease transfer.	WDFW, Tribes	USFWS	Phase 1	Completed as part of this initiative and updated periodically.
2. Identify risk aversion measures to reduce risks of hatchery programs.	See Part Three, 3.3 for detailed description of risk aversion measures including protocol for broodstock collection, species-specific limitations on hatchery releases to reduce or eliminate potential for predation and competition, and protocol for fish disease management.	WDFW, Tribes, USFWS		Phase 1	Completed as part of this initiative.
3. Implement identified risk aversion measures.	Apply risk aversion measures to hatchery programs as identified in 3.3.2 of Part Three.	WDFW, Tribes, USFWS	HCSEG, WOS, NOSC, LLTK	Phase 1	Immediate.
Objective: Assess and respond to other potential negative species interactions with summer chum (see 3.3).					
1. Evaluate impacts of fall chum spawning activity on summer chum.	Design and implement assessment of impacts from fall chum spawning within same stream reaches in which summer chum spawn.	WDFW, Tribes	Agencies and others with funding resources.	Phase 2	Undetermined.
2. Assess impacts of pinniped predation on summer chum.	Continue study to assess pinniped populations and impacts on salmon within Hood Canal..	NMFS, WDFW	Tribes and other agencies or entities	Phase 1	Continuing.
3. Implement appropriate management actions based on assessments of negative interactions.	Management actions may include control of individual seals or populations, and short-term limiting of fall chum escapement levels in designated streams.	NMFS WDFW, Tribes	Phase 1 or 2	When appropriate.	

4.2.3 Harvest Management

Harvest management provisions have been developed within this initiative to manage fisheries in a manner that will allow the rebuilding and maintenance of self-sustaining summer chum populations throughout Hood Canal and eastern Strait of Juan de Fuca, while maximizing harvest opportunities on co-mingled salmon species. The harvest management strategy utilizes a conservative four-way control mechanism: 1) a base set of conservative fishing regulations, 2) abundance and escapement thresholds that trigger adjustments to the fishing regime, 3) exploitation rate objectives that will result in changes to the harvest regime if not met, and 4) overall stock assessment criteria that will affect all plan provisions, including harvest, if not satisfactorily met at periodic plan reviews. Following is a summary of harvest management actions. Detailed descriptions may be found in Part Three, section 3.5.

Table 4.3 Harvest Management objectives and action items.

Objective: Define and implement a base conservation harvest regime that will halt the decline of summer chum and allow rebuilding.

Action Items	Description	Jurisdiction/ Authority	Partners	Resources/ Funding	Time Frame
1. Review and analyze existing data to determine basis for effective harvest management.	Escapement, catch and fisheries data have been compiled and analyzed (see Part One and Part Three, 3.5) and the structure of a base conservation harvest regime has been established (see Part Three, 3.5).	WDFW, Tribes		Phase 1	Completed as part of this initiative.
2. Identify specific harvest management actions within the conservation based harvest regime.	Harvest management actions include no directed harvest on summer chum and specific time, area and gear restrictions on other species to reduce summer chum bycatch to very low levels (details in Part Three, 3.5).	WDFW, Tribes		Phase 1	Completed as part of this initiative.
3. Implement harvest management actions.	Protective harvest management actions have been in effect since 1992. The base conservation harvest regime developed for this initiative more clearly defines and expands upon ongoing management actions. Implementation is effective immediately.	WDFW, Tribes		Phase 1	Continuing.
4. Maintain summer chum exploitation rates substantially below levels observed during years of decline, and at levels that will not impede recovery.	Exploitation rates are evaluated each year and additional harvest management measures taken if rates fall outside defined range. Additionally, every 5 years, exploitation rates will be evaluated for longer term effects and actions taken as determined appropriate (see Part Three, 3.5 and 3.6).	WDFW, Tribes		Phase 1	Completed as part of this initiative.
Objective: Ensure that base conservation harvest regime is working effectively.					
5. Evaluate the base conservation regime assumptions.	Exploitation rates are evaluated each year and additional harvest management measures taken if rates fall outside defined range. Additionally, every 5 years, exploitation rates will be evaluated for longer term effects and actions taken as determined appropriate (see Part Three, 3.5 and 3.6).	WDFW, Tribes		Phase 1	Continuing.

Table 4.3 Harvest Management objectives and action items (continued).

Action Items	Description	Jurisdiction/ Authority	Partners	Resources/ Funding	Time Frame
2. Evaluate stocks and harvest management units performance against minimum abundance and spawning distribution criteria.	Criteria (thresholds) are described in Part One, 1.7.3 and Appendix Report 1.5. Reviews occur annually (Part Three, section 3.6). If criteria are not met, causes for failure are evaluated and appropriate actions are taken applicable to harvest, habitat and supplementation programs.	WDFW, Tribes	Other agencies and entities	Phase 1	Annual reviews begin with 1999. First five year review in 2004.
Objective: Determine what constitutes a recovery harvest regime.					
1. Define recovery criteria and recovered harvest regime.	Within one year, criteria for recovered stocks and harvest management units should be developed upon which a recovery based harvest regime will be defined. The conservation based harvest regime will remain in effect until recovery criteria are met.	WDFW, Tribes.		Phase 1	Within one year.

4.2.4 Habitat

Strategies for addressing habitat factors for decline have been identified by the co-managers (Part Three, section 3.4). The local governments and agencies with jurisdiction are expected to take the lead in selecting and implementing specific actions based on the strategies. The co-managers anticipate providing technical assistance in the process of determining specific habitat protection and recovery actions, to the extent available resources will allow. An overview of habitat objectives and strategies is presented in Table 4.4, followed immediately by Table 4.5 that describes specific objectives, strategies and potential actions for individual stocks and watersheds.

Table 4.4 Region-wide habitat objectives and strategies.

Objective: Develop a high level of certainty that the habitat component of plan will be completed and implemented.

Strategy	Description	Jurisdiction/ Authority	Partners	Resources/Funding	Time Frame
1. Engage local governmental bodies and other entities in continuing the development and implementation of the program for habitat protection and recovery.	Development of a habitat program has begun with this plan in the description of strategies for the protection and recovery of summer chum in response to specific habitat-related factors for decline (Part Three, section 3.4). To have an effective program, local governments and citizens must participate in its development because the local governments have the jurisdiction to implement the needed measures and because without local support, implementation will not succeed. This action requires presentation of this plan to the local governments and entities, who will then lead in developing additional planning and specific actions to address the habitat-related factors for decline (see also the immediately following strategy). Working through local groups, efforts should be made to educate the public about importance of functional habitats and associated management actions for the protection and recovery of summer chum and other species.	Mason, Kitsap, Jefferson and Clallam Counties, HCCC, DNR, DOE, DOT, USFS, WDFW, Tribes.	Local groups and citizens, other agencies.	Use existing funding and resources, Phase 1.	Immediate.
2. Complete development and begin implementation of the habitat component of the plan.	The next stages of habitat program development involve the selection and implementation of specific measures or actions. These measures include broad-based regulatory actions affecting land use practices in the watersheds and estuaries (for example, establishing riparian protection zones, limiting development of impervious surfaces, more effective regulation of shoreline structures), and specific habitat recovery actions (for example, acquiring land or easements to protect habitat from development, removing or setting back dikes). An evaluation procedure for prioritizing specific local recovery actions is suggested in Part Three, section 3.4). Applications to specific watersheds are summarized in Table 4.5 and presented in detail within Appendix Report 3.6.	Mason, Kitsap, Jefferson and Clallam Counties, HCCC, DNR, DOE, DOT, USFS.	WDFW, Tribes, local groups and citizens, other agencies.	Phases 1 and 2.	Immediate.

Table 4.4 Region-wide habitat objectives and strategies (continued).

Objective: Develop a high level of certainty that the habitat component of plan will be completed and implemented.

Strategy	Description	Jurisdiction/ Authority	Partners	Resources/Funding	Time Frame
Objective: Maintain and restore critical subestuarine and nearshore/shoreline processes and conditions.					
1. Prohibit further ditching, diking and road construction in subestuaries, and prohibit or severely restrict bulkheading as well as construction of new piers, docks and floats along shorelines.	Further degradation of estuarine habitats is to be avoided wherever possible. Exemptions for single family residences should be removed from the Shoreline Management Master Plan. Critical habitat areas especially require protection. Consideration should be given to requiring use of joint facilities (e.g., docks, floats) away from critical areas and use of alternatives to bulkheading. Sources of marine sediment (feeder bluffs, etc.) Must be allowed to provide sediment to the marine environment for the maintenance of spits, beaches, and other nearshore habitat features. Mitigation should be required for any unavoidable developments (see Part Three, 3.4).	Counties	Agencies, tribes and other interested parties	Phase 1, possibly Phase 2.	Immediate
2. Identify and purchase from willing landowners property or easements of undeveloped, subestuarine and shoreline areas.	Summer chum rely on diverse, productive and structurally complex habitats in the estuarine areas. Undeveloped critical areas should be protected from future development by purchase of property or easements (see Part Three, 3.4).	Counties, agencies, non-profit organiz-ations.	Agencies, tribes and other interested parties.	Phase 2	As funding resources become available.
3. Remove or set back dikes and refit or remove roads/causeways in subestuaries. Re-establish dendritic channels and patterns of inundation in deltas, and restore sinuous main-stream channels in subestuarine areas.	Restoration of habitat in the subestuaries is a critical component of summer chum recovery (see Part Three, 3.4). Restoration will provide unrestricted tidal and freshwater circulation, natural sediment transport and storage, and development of marshes, swamps and eel grass beds, all of which contribute to high quality summer chum rearing and migrating habitat.	Counties	Agencies, tribes and other interested parties.	Phase 2	As funding becomes available.
4. Establish vegetation buffer requirements for marine shorelines. Place critical nearshore migratory pathways in marine reserves.	Vegetation buffers protect natural shoreline processes and limit effects of development. Critical nearshore migratory pathways will need to be identified and given adequate protection (Part Three, 3.4).	Counties	Agencies, tribes and other interested parties.	Phase 1	As soon as possible.

Table 4.5 Stock and watershed specific habitat objectives, strategies and potential actions.

A. Dungeness Stock (see also action to evaluate summer chum population in Table 4.6)

Objective: Restore salmonid habitat in the Dungeness River (see Appendix Report 3.6).

Strategy/Action	Description	Jurisdiction/ Authority	Partners	Resources/ Funding	Time Frame
1. Re-establish functional flood plain in the lower 2.6 miles of river (dike removal and constriction abatement). 2. Abate man-made constrictions above RM 2.6. 3. Create stable long-term log jams. 4. Manage sediment to stabilize channel and reduce flooding risk. 5. Construct and/or protect side channels. 6. Restore riparian vegetation. 7. Conserve instream flows. 8. Decrease water quality impacts in Dungeness Bay to control harmful ulvoid blooms. 9. Restore estuarine habitat and functions in Dungeness Bay and along juvenile summer chum migration corridors (e.g., Gierin Creek estuary).	The Dungeness River has been subject to numerous planning processes. A Watershed Council and technical workgroup have been working for several years on a comprehensive plan to guide salmonid restoration. The plan, which incorporates the seven actions/strategies listed here, was approved by the Watershed Council in 1998. These continuing efforts, assuming adequate funding, are expected to result in the restoration of habitat functions to the benefit of summer chum as well as other salmonid species.	Jamestown S'Klallam Tribe, Clallam County, state and federal agencies.	Property owners and others.	Phases 1 and 2.	Ongoing
B. Jimmycomelately Stock					
Objective: Re-establish estuary to freshwater linkages and functions (see Appendix Report 3.6).					
1. Reconnect and expand existing connections between freshwater reaches of flood plain and tidal delta.	The poor connections and habitat conditions at the freshwater/estuary interface is viewed as the primary issue to be addressed in restoring summer chum habitat of Jimmycomelately Creek. An estuary technical workgroup has been established to determine the scope of restoration actions, and to identify funding sources and time lines.	Clallam County, DOT.	Clallam Conservat. District, WDFW, Jamestown S'Klallam Tribe, WSU Coop. Ext., land-owners and others.	Phases 1 and 2.	Early stages.

Table 4.5 Stock and watershed specific habitat objectives, strategies and potential actions (continued).

Strategy/Action	Description	Jurisdiction/ Authority	Partners	Resources/ Funding	Time Frame
2. Remove secondary roads and railroad grade that limit tidal circulation and fish movement. 3. Fill remnant ditches. 4. Mitigate and eliminate log storage and handling impacts. 5. Create stable logjams to increase channel complexity. 6. Restore estuarine habitat and functions in Sequim Bay and along juvenile summer chum migration corridors (e.g., Bell Creek estuary).					
C. Salmon/Snow Stock - Salmon and Snow Watersheds					
Objective: Restore stream habitat functions (see Appendix Report 3.6).					
1. Return stream channel to sinuous morphology. 2. Control sediment inputs to natural levels. 3. Create stable logjams to increase channel complexity. 4. Restore riparian vegetation.	These measures address the major impacts assessed to be limiting habitat functions in Salmon and Snow creeks and affecting freshwater life stages of summer chum. Restoration activities were begun in 1995 in Snow Creek north of Highway 101 and west of State Road 20 to abate channel constriction, re-establish pools, lower streambed and place LWD in stream. A more comprehensive restoration effort can be built on these initial activities. Additional assessment may be needed to prepare for actions.	Clallam County, DOT	Clallam Conserv. District, WDFW, James-town S'Klallam Tribe, WSU Coop. Ext., landowners and others.	Phase 2	As funding becomes available.
Objective: Re-establish estuary to freshwater linkages and functions (see Appendix Report 3.6).					
1. Remove railroad grade. 2. Remove or set back dikes.	The railroad grade limits tidal circulation for both creek deltas and is located at the center of emergent marsh rearing habitat on Snow Creek. Dike removal on both creeks must be carefully planned because of the integration of diked areas with Highway 101 transportation corridor. Additional assessment may be required to prepare for actions	Clallam County, DOT	Clallam Conserv. District, WDFW, James-town S'Klallam Tribe, WSU Coop. Ext., land-owners and others.	Phase 2	As funding becomes available.

Table 4.5 Stock and watershed specific habitat objectives, strategies and potential actions (continued).

Strategy/Action	Description	Jurisdiction/ Authority	Partners	Resources/ Funding	Time Frame
D. Chimacum Watershed					
Objective: Recover summer chum habitat in lower stream reaches (see Appendix Report 3.6).					
1. Replace road fill and culvert at Irondale Rd. crossing. 2. Re-establish riparian forest on east and west forks. 3. Restore wetlands. 4. Protect wetlands and riparian areas downstream of Irondale Rd. 5. Protect lower river floodplain and estuary. 6. Restore estuarine and nearshore habitat by removing fill from approximately 18 to 20 acres of former intertidal habitat located immediately south of the Chimacum Creek mouth. 7. Decrease water quality impacts to the estuary and associated nearshore areas.	These measures address the major limiting factors affecting summer chum in Chimacum Creek. The work at the Irondale Rd. crossing is to remove possibility of future culvert failure. Riparian restoration will help reduce high summer temperatures and input of fine sediment. Wetland restoration will help control summer and winter flow conditions. Assessment of winter and summer flow effects is also needed. The Jefferson Land Trust and WDFW are currently working to acquire conservation easements including riparian areas. The tidal floodplain and estuary are undeveloped and should be protected by acquisition and regulation.	Jefferson County	WDFW, Tribes and local groups.	Phase 2	As soon as funding is available.
E. Quilcene Stock - Big and Little Quilcene Watersheds					
Objective: Determine instream flows needed to support summer chum during immigration and spawning life stages in the Big and Little Quilcene rivers (see Appendix Report 3.6).					
Perform instream low flow assessment and recommend summer instream low flow levels and associated habitat improvements.	Because of water withdrawals, summer low flows are believed to be limiting immigration and spawning life stages in the Big and Little Quilcene. An assessment of low flow needs should be performed using appropriate methodology and considering other factors (e.g. channel aggradation) that may affect summer chum habitat in conjunction with low flows. A recommendation of instream low flow levels and any associated habitat improvements should be developed based on the results of the assessment.	DOE, Jefferson County, WDFW.	Tribes, City of Port Town-send, other agencies and interested parties.	Undetermined - Phase 2	As soon as funding /resources are available.

Table 4.5 Stock and watershed specific habitat objectives, strategies and potential actions (continued).

Strategy/Action	Description	Jurisdiction/ Authority	Partners	Resources/ Funding	Time Frame
Objective: Meet and maintain recommended instream low flow levels and associated habitat improvements in the Big and Little Quilcene rivers.					
Develop and implement process to gain acceptance of instream low flow levels and associated habitat improvements, to seek needed funding and to follow-up with specific actions to meet objective.	The governing bodies with jurisdiction, directly affected parties and others should convene to review results of the instream flow assessment and develop a cooperative response to meeting instream flow needs and addressing associated habitat improvements. Funding requirements should be determined and a strategy developed to secure the funds. The funding strategy should be implemented and specific actions should be taken to ensure instream low flow levels are met and to secure associated habitat improvements critical to successful instream low flow conditions.	Jefferson County, City of Port Town-send, Dept. of Ecology, WDFW, any affected landowners.	Tribes, other agencies and interest-ed parties.	Undetermined - Phase 2	Immediately following completion of instream flow assessment
Objective: Protect or improve channel complexity, reduce channel aggradation effects, and protect and improve riparian conditions in the lower rivers (see Appendix Report 3.6).					
1. Purchase from willing landowners property and easements adjacent to stream reaches and in the flood plains of the lower rivers and subestuaries.	In the lower Big Quilcene River (downstream of RM 1.0), the exact location of the river is controlled in large part by the placement of dikes; natural lateral river movement is constrained and sediment aggradation occurs in a restricted area. The effect has been to reduce channel complexity and exacerbate negative effects of sediment aggradation. The purchase of property or easements in this reach of the river, complemented by removal and setting back of dikes (see below) and obtaining appropriate instream low flow conditions (see above) will return natural river and flood plains interactions and functions, will increase channel complexity, and will significantly improve summer chum habitat conditions in the lower river. The purchase of this land will eliminate the need to protect the existing land uses of the current landowners from effects of flooding and thus will allow for more natural river functions. The reach of the Big Quilcene River from RM 1.0 to 2.5 is constrained by farmers and residents who have armored the banks to restrict river movement. Purchase of property or flood plain easements will allow the river to move more naturally across the flood plain, will lead to improved riparian conditions and will increase channel complexity. The lower Little Quilcene River contains a few remaining spawning areas with intact riparian forest and good instream habitat. Purchase of property or easements will protect these areas from degradation.	Jefferson County, willing land-owners.	Tribes, WDFW, other agencies and interest-ed parties.	Undetermined - Phase 2.	Immediately as funds become available

Table 4.5 Stock and watershed specific habitat objectives, strategies and potential actions (continued).

Strategy/Action	Description	Jurisdiction/ Authority	Partners	Resources/ Funding	Time Frame
2. Remove or set back dikes in the flood plain and estuary.	Removal and setting back of dikes could provide access to substantial amounts of the flood plains and estuaries of the Big and Little Quilcene rivers. Natural lateral river movement, accompanied by improved distribution of sediments, greater channel complexity and improved riparian conditions would result in much improved habitat to the benefit of summer chum.	Jefferson County, willing land-owners.	Tribes, WDFW, other agencies and interest-ed parties.	Undetermined - Phase 2.	As funds become available
3. Reduce future development in the flood plain by restricting construction permits.	Permits should be restricted to not allow new construction of residences or other developments in flood plain areas that currently accommodate natural stream/flood plain interactions and functions. The purpose would be to avoid further diminution of natural processes that support desirable summer chum habitat conditions. The flood plain on the north side of the Little Quilcene River below RM 0.7 is a natural flood plain area that should be protected from development.	Jefferson County.	Other counties, agencies tribes and interest-ed parties.	Undetermined - Phase 2 if needed.	Immediate.
4. Determine sources and extent of sediment aggradation and scouring problems.	The sources of sediment aggradation on the Little Quilcene should be determined using existing watershed analysis methods. The extent and dynamics of sediment aggradation and scouring effects should be assessed in the lower Big and Little Quilcene rivers. These assessments will provide a better understanding of the scope of the aggradation and scouring problems that exist in the lower rivers, and indicate what actions may be taken to rectify the problems, leading to improved habitat conditions for summer chum.	U.S. Forest Service (upper watershed sediment source areas), Jefferson County .	Other agencies tribes and interest-ed parties.	Undetermined - Phase 2 if needed.	As funds become available
5. Restore natural levels of LWD to the anadromous use zones of both rivers.	The Big and Little Quilcene rivers are extremely deficient in stable LWD. Restoring LWD will contribute to channel stability and complexity.	U.S. Forest Service, Jefferson County	Other agencies, tribes and interested parties.	Phase 2	As funds become available.
6. Restore natural meandering configuration to the channelized reach of the Big Quilcene River between approximately river mile 2.5 and 2.8.	Channelization of this portion of river in 1950s has led to extremely simplified and impaired habitat ever since. Also, with the river being confined against the valley wall in this area, high rates of bluff erosion and sediment recruitment into the river have occurred. Restoring the channel to a meandering configuration will restore channel complexity, reduce stream energy and allow the river to move away from the highly erodible slopes.	Jefferson County	Other agencies, tribes and interested parties.	Phase 2	As funds become available.

Table 4.5 Stock and watershed specific habitat objectives, strategies and potential actions (continued).

Strategy/Action	Description	Jurisdiction/ Authority	Partners	Resources/ Funding	Time Frame
7. Remove artificially aggraded sediments from the Big Quilcene and Little Quilcene river delta cones.	Channelization of these streams has caused the development of abnormal delta cones that have buried intertidal estuarine habitat at these stream mouths. These delta cones should be removed to restore estuarine habitat and contribute to the stability of the lower reaches of these streams. Similar consideration should be given to removing delta cones of other streams in Quilcene Bay estuary (i.e., Indian and Jakeway creeks).	Jefferson County	Other agencies, tribes and interested parties.	Phase 2	As funds become available.
F. Dosewallips Stock					
Objective: Protect and improve summer chum habitat (see Appendix Report 3.6).					
1. Purchase property or conservation easements in lower 3.0 miles of watershed.	Development pressures are highly concentrated in the lower 3.0 miles of river, where most summer chum use occurs. Acquisition of property or easements from willing landowners will ensure future protection and recovery of summer chum habitat. The potential also exists for planting conifers in the riparian zone and placing engineered logjams to improve channel complexity and stabilize spawning gravels.	Jefferson County and state/federal agencies	Tribes and other interested parties	Phase 2	When funding is available
2. Restore tidal circulation across the subestuary.	Existing and failed dikes have disconnected the wetlands across the delta. Removing or setting back the dikes would allow more natural tidal circulation and access to habitat. Tidal channels north of the river mouth could be reconnected to the mainstem river.	Jefferson County and state/federal agencies	Tribes and other interested parties	Phase 2	When funding is available
3. Restore natural levels of LWD to the anadromous use zones of the Dosewallips River.	The Dosewallips River if deficient in stable LWD. Restoring LWD will contribute to channel complexity and stability.	Jefferson County and state/federal agencies.	Tribes and other interested parties.	Phase 2	When funding is available.
G. Duckabush Stock					
Objective: Protect and improve summer chum habitat (see Appendix Report 3.6).					
4. Purchase property or conservation easements in lower 2.5 miles of watershed.	Development pressures are highly concentrated in the lower 2.5 miles of river, where most summer chum use occurs. Acquisition of property or easements from willing landowners will ensure future protection and recovery of summer chum habitat. The potential also exists for planting conifers in the riparian zone and placing engineered logjams to improve channel complexity and stabilize spawning gravels.	Jefferson County and state/federal agencies	Tribes and other interested parties.	Phase 2	When funding is available.

Table 4.5 Stock and watershed specific habitat objectives, strategies and potential actions (continued).

Strategy/Action	Description	Jurisdiction/Authority	Partners	Resources/Funding	Time Frame
2. Restore tidal circulation across the subestuary.	Rerouting or refitting the Highway 101 road causeway across the delta would help restore tidal circulation and juvenile salmon migration and rearing in the subestuary. Removal or setting back of one of the dikes in the northern delta would reconnect additional delta area.	Jefferson County, DOT, state/federal agencies	Tribes and other interested parties	Phase 2	When funding is available
H. Hamma Hamma Stock					
Objective: Protect and improve summer chum habitat (see Appendix Report 3.6).					
3. Protect and restore riparian forests.	Logging and timber salvage in riparian zone has reduced LWD recruitment into the stream and has increased soil erosion and landslide hazards. Providing an adequate riparian forest buffer and avoiding harvest on steep slopes is recommended. Engineered logjams may be placed to improve channel habitat complexity.	Mason County, DOT, state / federal agencies.	Land-owner, tribes and other interested parties	Phases 1 and 2	Immediate
4. Restore tidal circulation across the subestuary.	Reconnecting the lower river with the north bank marsh would restore fish access to subestuarine habitat used for rearing and refuge. An assessment of this action and others in the delta area is needed to determine nature and feasibility of actions.	Mason County, DOT, state / federal agencies.	Land-owner, tribes and other interested parties	Phase 2	Immediate
I. Lilliwaup Stock					
Objective: Protect and improve summer chum habitat (see Appendix Report 3.6).					
1. Restore riparian forest in lower river.	Restriction of human activities associated with agricultural and residential developments would allow riparian forests to become reestablished, providing a source of LWD to increase channel complexity.	Mason County	Land-owners, tribes and other interested parties.	Phase 1	Immediate

Table 4.5 Stock and watershed specific habitat objectives, strategies and potential actions (continued).

Strategy/Action	Description	Jurisdiction/ Authority	Partners	Resources/Funding	Time Frame
2. Protect wetlands in upper Lilliwaup valley.	The DNR-owned wetlands are believed to play a major role in sustaining summer flows. The land should be managed to ensure the wetlands are maintained.	DNR	Tribes and other interested parties.	Phase 1	Continuing.
3. Restore natural tidal channel system.	The natural tidal channel system of the subestuary is impacted by the Highway 101 road causeway. The causeway should be relocated or refitted to reduce impact.	DOT	Tribes and other interested parties.	Phase 2	When funded.
J. Skokomish Stock					
Objective: Protect and improve freshwater natural habitat conditions (see Appendix Report 3.6).					
1. Restore natural flows in the North Fork.	Substantial restoration of North Fork flows (currently diverted by the Cushman Hydroelectric Project) would restore historic habitat conditions, reduce or eliminate sediment aggradation in the main channel, and improve conditions for upstream adult salmon migration during the summer low flow months.	U.S. Dept. of Interior	City of Tacoma, state and federal agencies, Skok. Tribe	Phase 1 and possibly Phase 2.	In process.
2. Improve hydrological conditions throughout watershed.	Reducing road densities through obliteration and decommissioning and improving drainage of remaining roads by installing larger and more frequent cross drains and water bars will help restore ecosystem processes and lessen peak flow impacts. By allowing the forest to mature, general hydrologic conditions will improve and rain on snow impacts will be reduced.	Federal and state agencies, Mason County	Skok. Tribe	Phases 1 and 2	Immediate
3. Restore riparian condition through revegetation	Revegetation of the riparian corridor together with decommisioning dikes and fencing livestock will improve the river connection with the floodplain and improve riparian benefits (e.g., provide source of LWD).	Mason County	Conserv. Dist. , state and federal agencies, Skok. Tribe, land-owners	Phases 1 and 2	Immediate

Table 4.5 Stock and watershed specific habitat objectives, strategies and potential actions (continued).

Strategy/Action	Description	Jurisdiction/ Authority	Partners	Resources/Funding	Time Frame
4. Provide for natural movement of the river across the floodplain.	Removal of dikes and purchase of property or easements from willing landowners would allow the river to move across and integrate more naturally with the flood plain, creating improved habitat conditions. Habitat diversity may be improved by reconnecting isolated sloughs and side channels.	Mason County	State and federal agencies, Skok. Tribe, land-owners	Phase 2	Depends on funding.
Objective: Restore delta functions.					
Convert lands back to estuarine wetlands with natural distributary channels.	Remove dikes and tide gates, and remove or relocate roads to provide unimpeded tidal circulation in river delta. A key part of the subestuary's recovery is the restoration of North Fork flows that strongly affect the delta's ecological processes and would reduce the long term sediment aggradation in the main channel. The actions will restore summer chum migration and rearing habitat.	Mason County	State and federal agencies, Skok. Tribe, land-owners	Phase 2	Depends in part on funding.
K. Union Stock					
Objective: Protect and improve subestuarine habitat (see Appendix Report 3.6).					
5. Purchase property or conservation easements in undeveloped subestuarine or shoreline areas.	Acquisition of properties or easements from willing landowners will secure permanent protection of undeveloped, natural areas that provide summer chum rearing and migratory habitat.	Mason County	Agencies, tribes, landowners	Phase 2	Contingent on funding.
6. Recover habitat through removal or setting back dikes and removal of unnecessary fills and bulkheads.	There is a need to assess the effectiveness of the dikes, fills and bulkheads and their impact on the subestuarine environment. Based on results of assessment, restoration opportunities may be explored and negotiated with the landowners.	Mason County	Agencies, tribes, landowners	Phase 2	Contingent on funding.

Table 4.5 Stock and watershed specific habitat objectives, strategies and potential actions (continued).

Strategy/Action	Description	Jurisdiction/Authority	Partners	Resources/Funding	Time Frame
Objective: Protect and improve stream habitat (see Appendix Report 3.6).					
1. Restore riparian forest.	Encourage riparian revegetation throughout the stream corridor. Upgrade riparian protection through ordinances. Existing riparian forests may be improved by underplanting shade tolerant conifers.	Mason County	Agencies, tribes, landowners	Phases 1 and 2	Immediate.
2. Increase channel complexity.	Channel complexity may be improved by allowing natural input processes for woody debris to occur and by leaving LWD in the stream channel. Consider placing engineered logjams in channel.	Mason County	Agencies, tribes, landowners	Phases 1 and 2	Immediate.
3. Improve water quality.	Raise standards for best management practices utilized by industrial landowners, small farms and residential homeowners to reduce impacts on habitat and water quality. Enact effective stormwater protection measures.	Mason County	Agencies, tribes, landowners	Phase 1	Immediate.
L. Big Mission Watershed					
Objective: Protect and improve subestuarine habitat (see Appendix Report 3.6).					
4. Purchase property or conservation easements in undeveloped subestuarine or shoreline areas.	Acquisition of properties or easements from willing landowners will secure permanent protection of undeveloped, natural areas that provide summer chum rearing and migratory habitat.	Mason County	Agencies, tribes, land-owners	Phase 2	Contingent on funding.

Table 4.5 Stock and watershed specific habitat objectives, strategies and potential actions (continued).

Strategy/Action	Description	Jurisdiction/Authority	Partners	Resources/Funding	Time Frame
2. Recover habitat through removal or setting back dikes and removal of unnecessary fills and bulkheads.	The condition and effectiveness of dikes, fills and bulkheads, and their impact on the subestuarine environment should be assessed. Based on results of assessment, restoration opportunities should be explored and negotiated with the landowners. Explore with Washington Parks Dept. the potential of reconfiguring the lower stream channel.	Mason County	Agencies, tribes, land-owners	Phase 2	Contingent on funding.
Objective: Protect and improve stream habitat (see Appendix Report 3.6).					
3. Restore riparian forest.	Encourage riparian revegetation throughout the stream corridor. Upgrade riparian protection through ordinances. Consider purchasing from willing landowners critical undeveloped properties or conservation easements on developed properties that can be enhanced. Existing riparian forests may be improved by underplanting shade tolerant conifers. Link the DNR riparian forests in the middle reaches of stream with riparian forests in the lower reaches.	Mason County	Agencies, tribes, land-owners	Phases 1 and 2	Immediate.
4. Increase channel complexity.	Channel complexity may be improved by allowing natural input processes for woody debris to occur and by leaving LWD in the stream channel. Consider placing engineered logjams in channel. Assess capacity of bridges/culverts to pass wood, water and sediment to lower reaches; replace or improve these structures where appropriate. Where possible, remove rip rap or replace with bio-engineered shoreline protection.	Mason County	Agencies, tribes, land-owners	Phases 1 and 2	Immediate.

Table 4.5 Stock and watershed specific habitat objectives, strategies and potential actions (continued).

Strategy/Action	Description	Jurisdiction/Authority	Partners	Resources/Funding	Time Frame
M. Tahuya Watershed					
Objective: Protect and improve stream habitat (see Appendix Report 3.6).					
1. Protect and improve riparian condition.	Allowing existing forests to mature and providing adequate riparian buffers will over time protect and improve riparian processes. As riparian condition improves, potential effects of high water temperatures (i.e., limiting distribution of returning adults) will be mitigated.	Mason County, DOT	Agencies, tribes, landowners	Phases 1 and 2	Immediate.
2. Increase channel complexity.	Channel complexity will increase by allowing the river to migrate naturally across the 100 year floodplain. Opportunities for elimination of bank hardening and stream channelization that limit natural river movement should be pursued.	Mason County, DOT	Agencies, tribes, landowners	Phases 1 and 2	Immediate.
3. Protect instream flows.	Negative impacts on instream flows are likely with development in the watershed unless effective management is applied. Impervious surfaces should be limited, storm water control measures planned and implemented, and drainage structures sized to allow for 100 year storm events.	Mason County, DOT	Agencies, tribes, landowners	Phases 1 and 2	Immediate.
4. Protect and improve subestuarine habitat.	Efforts should be made to protect estuary from further development, especially bank hardening. Existing road causeways constrict water circulation and should be refitted to reduce impact.	Mason County, DOT	Agencies, tribes, landowners	Phases 1 and 2	Immediate.
N. Dewatto Watershed					
Objective: Protect and improve stream habitat (see Appendix Report 3.6).					
1. Protect and improve riparian condition.	Riparian functions will improve as the existing riparian forest matures over the next 25-50 years. Adequate protection through regulation and enforcement will ensure functions such as LWD recruitment, and moderation of water temperatures will naturally improve over time.	Mason County, DOT	Agencies, tribes, land-owners	Phases 1 and 2	Immediate.

Table 4.5 Stock and watershed specific habitat objectives, strategies and potential actions (continued).

Strategy/Action	Description	Jurisdiction/Authority	Partners	Resources/Funding	Time Frame
2. Upgrade road conditions.	Fine sediments in spawning gravels may be reduced by routing road drainage away from stream channels, stabilizing sidecasts, hardening road surfaces, upgrading stream crossings to pass 100-year flood events and, where possible, decommisioning roads.	Mason County, DOT	Agencies, tribes, land-owners	Phases 1 and 2	Immediate.
3. Improve channel complexity.	Restore natural function within the 100-year flood plain by removing or redesigning constraints to natural channel development. Such constraints include bank hardening and channelization.	Mason County, DOT	Agencies, tribes, land-owners	Phases 1 and 2	Immediate.
4. Protect subestuary.	The subestuary is one of few relatively undisturbed deltas. Specific measures should be sought to ensure its protection; e.g., purchase of conservation easements and regulation of land use.	Mason County, DOT	Agencies, tribes, land-owners	Phases 1 and 2	Immediate.
O. Big Anderson Watershed					
Objective: Protect and improve stream habitat (see Appendix Report 3.6).					
5. Protect and improve riparian condition.	Increase riparian buffer and provide adequate protection. Plant conifers throughout flood plain in lower one mile of stream.	Kitsap County, DOT	Agencies, tribes, land-owners	Phases 1 and 2	Immediate.
6. Reduce unnatural instream sediment accumulation and reduce adverse peak flow effects.	Avoid logging on potentially unstable slopes and decommission or repair roads that have high surface erosion or landslide hazard. Limit new road construction. Increase water bars and cross drains on forest roads. Redirect roadside ditches to avoid direct routing of storm flows into stream channels.	Kitsap County, DOT	Agencies, tribes, land-owners	Phases 1 and 2	Immediate.
7. Improve habitat in lower river flood plain and subestuary.	Relocate roads out of flood plain or replace road fill with structures that allow channel movement and passage of flood waters. Alternatively, roads may be set back or rerouted within flood plain to improve habitat. Remove abandoned railroad fill in subestuary.	Kitsap County, DOT	Agencies, tribes, land-owners	Phase 1 and 2	Immediate.

Table 4.5 Stock and watershed specific habitat objectives, strategies and potential actions (continued).

Strategy/Action	Description	Jurisdiction/Authority	Partners	Resources/Funding	Time Frame
P. Stavis Watershed					
Objective: Protect and improve stream habitat (see Appendix Report 3.6).					
1. Protect existing high quality habitat	Continue and expand acquisitions under the Hood Canal Salmon Sanctuary. Highest priority is estuary and adjacent uplands, but also important are adjoining shoreline areas, lower mainstem and flood plain, and wetland hydrologic source areas.	Kitsap County	Agencies, tribes, land-owners	Phases 1 and 2	Immediate.
2. Protect and restore riparian forest.	For properties acquired in lower watershed, replant streamside areas lacking sufficient riparian forest or appropriate species and abandon any associated roads. Consider treatments to encourage conifer regeneration on WDFW properties. Reforest narrow riparian zones on upstream DNR lands. Establish appropriate riparian zone widths to provide long-term LWD recruitment. Assess West Kitsap Watershed Analysis prescriptions and modify as needed.	Kitsap County	Agencies, tribes, land-owners	Phases 1 and 2	Immediate.
3. Establish hydrologic maturity targets.	Set forest harvest rates to ensure hydrologic maturity. Address growth management issues to limit effects (e.g., from impervious services) on hydrologic maturity.	Kitsap County	Agencies, tribes, land-owners	Phases 1 and 2	Immediate.
4. Use Stavis Creek estuary as critical habitat template.	Establish long term monitoring programs to track estuarine quality.	Kitsap County	Agencies, tribes, land-owners	Phases 1 and 2	Immediate.
Q. Seabeck Watershed					
Objective: Protect and improve stream habitat (see Appendix Report 3.6).					
1. Control sediment sources.	Improve road maintenance and surfacing on private roads, and ensure storm water runoff is not routed directly into stream channel. Evaluate effectiveness of slope stability standards. Control timing of clearing and grading activities adjacent to creek to avoid storm events.	Kitsap County	Agencies, tribes, land-owners	Phase 1 and 2	Immediate

Table 4.5 Stock and watershed specific habitat objectives, strategies and potential actions (continued).

Strategy/Action	Description	Jurisdiction/Authority	Partners	Resources/Funding	Time Frame
2. Improve channel complexity.	Place LWD jams in lower river if determined to be feasible.	Kitsap County	Agencies, tribes, land-owners	Phases 1 and 2	Immediate.
3. Protect flow conditions.	Prohibit new water withdrawals until instream flow requirements are established. Establish impervious surface limits and condition land use permits accordingly. Retrofit existing developments for storm water control. Maintain minimum 60% of watershed in forest cover.	Kitsap County	Agencies, tribes, land-owners	Phases 1 and 2	Immediate.
4. Protect and restore riparian habitat.	Acquire high quality riparian forest to protect habitat. Replant riparian buffers with native species to improve habitat. Review and revise critical area ordinance to meet recommended functional riparian buffer standards.	Kitsap County	Agencies, tribes, land-owners	Phases 1 and 2	Immediate.
5. Protect subestuary.	Prevent further development within subestuary by land acquisition or land use regulation.	Kitsap County	Agencies, tribes, land-owners	Phases 1 and 2	Immediate.
R. Big Beef Watershed					
Objective: Protect and improve stream habitat (see Appendix Report 3.6).					
1. Reduces sources of sediment aggradation.	Reduce mass wasting into lower five miles of stream by prohibiting logging and development on steep, unstable slopes. Address sediment contributions from existing abandoned and active roads (esp. Kidhaven Rd. at RM 3.2). Prohibit new roads on steep ravine slopes below Lake Symington. Monitor effectiveness of prescriptions for logging (West Kitsap Watershed analysis) and rural development (Critical Areas Ordinance).	Kitsap County, DOT	Agencies, tribes, land-owners	Phases 1 and 2	Immediate.
2. Increase channel complexity.	Remove service road located within flood plain & evaluate feasibility of restoring side channels and wetlands next to U.W. research facility. Assess role of WDFW weir in affecting sediment routing and investigate options for reducing its impact. Evaluate option of placing LWD jams in lower river.	Kitsap County, DOT	Agencies, tribes, land-owners	Phase 1 and 2	Immediate.

Table 4.5 Stock and watershed specific habitat objectives, strategies and potential actions (continued).

Strategy/Action	Description	Jurisdiction/Authority	Partners	Resources/Funding	Time Frame
3. Reduce causeway impact on delta.	Retrofit causeway by removing fill and expanding bridge span to reduce its footprint in the historic delta, promote full tidal water exchange and allow natural habitat development in subestuary.	Kitsap County, DOT	Agencies, tribes, land-owners	Phases 1 and 2	Immediate.
4. Improve flow conditions.	Condition water applications to ensure minimum instream flow recommendations are met. Establish impervious surface limits and condition land use permits accordingly. Maintain minimum 60% of watershed in forest cover. Institute water conservation programs and seek opportunities to reduce number of shallow wells in watershed. Require on-site infiltration of runoff from impervious surfaces where soils are appropriate. Ensure road drainage is not routed directly into stream channels.	Kitsap County, DOT	Agencies, tribes, land-owners	Phases 1 and 2	Immediate.
5. Protect and restore riparian forests.	Continue riparian area acquisition efforts under the Hood Canal Salmon Sanctuary program. Replant degraded riparian zones with appropriate native species. Review and revise critical area ordinance consistent with recommendations for riparian buffers.	Kitsap County, DOT	Agencies, tribes, land-owners	Phases 1 and 2	Immediate.

4.2.5 Monitoring and Evaluation

Monitoring and evaluation are intended to document compliance with the management actions described in this initiative and to help verify whether or not the expected results of those actions actually occur. They also are used to validate critical assumptions upon which management actions are based and address identified information gaps. Monitoring and evaluation are necessary to demonstrate the effectiveness of the initiative in addressing the factors for decline, in stopping population declines, and ultimately in recovering summer chum. Table 4.6 summarizes monitoring and evaluation objectives, strategies and actions.

Table 4.6 Monitoring and Evaluation - objectives, strategies and actions.

Objective: Document compliance of specific projects and actions with applicable guidelines, criteria or rules.

Strategy/Action	Description	Jurisdiction/ Authority	Partners	Resources/ Funding	Time Frame
1. Monitor summer chum supplementation and reintroduction projects for consistency with provisions and guidelines under the initiative and in support of adaptive management (section 3.2).	Monitoring is accomplished by required recording of all project operations including brood stocking, incubation, rearing, health, transfer and release of fish. Records, including building of new facilities, are summarized and made available in annual reports. Projects may be modified or even terminated based on monitoring results.	WDFW, USFWS, Tribes.	HCSEG, NOSC, WOS, LLTK.	Phase 1.	Immediate.
2. Monitor hatchery mitigation measures to reduce negative ecological interactions of other species with summer chum, consistent with provisions of section 3.3.	Hatchery records demonstrate level of compliance with identified mitigation actions. Results are summarized in annual report.	WDFW, USFWS, Tribes	Citizens and other partici-pant organiz-ations.	Phase 1.	Immediate.
3. Monitor harvest regulations and fisheries for consistency with plan provisions (section 3.5).	Records of harvest regulations are kept. Tribal and state fisheries enforcement programs promote compliance with regulations and record violations. Results are reviewed annually.	WDFW, Tribes		Phase 1.	Immediate.
4. Include compliance monitoring as part of habitat protection and restoration measures (section 3.4).	Documenting compliance with land use permits and regulations, and with specifications of habitat restoration projects, should be required in the development of these actions.	Local governments and agencies with jurisdiction	WDFW, Tribes	Phases 1 and 2	Immediate.
Objective: Measure effectiveness of actions and projects.					
1. Monitor adult returns from supplementation and reintroduction projects.	All artificially produced summer chum are marked or tagged so that returning hatchery origin fish may be sampled. Because all currently planned projects are integrated recovery programs, the focus is on number and proportion of natural origin returns (NORs) as the primary measure of project success. (Adequate sampling resources are critical for effective monitoring.) Artificial production program may be reduced or even terminated based on monitoring results (Part Three, 3.2).	WDFW, USFWS, Tribes	HCSEG, NOSC, WOS, LLTK	Phases 1 and 2	Immediate.

Table 4.6 Monitoring and Evaluation - objectives, strategies and actions (continued).

Strategy/Action	Description	Jurisdiction/ Authority	Partners	Resources/ Funding	Time Frame
2. Monitor catches, escapements, genetics, ages and fisheries exploitation rates.	Summer chum are not targeted in fisheries. However, catches of summer chum in fisheries for other species, with run timing that overlaps that of summer chum, are monitored, as are summer chum escapements to spawning grounds, genetic stock information, ages of summer chum and other biological data (see Part One). With this information, runs are reconstructed and exploitation rates estimated to measure the success of harvest controls and assess the condition of the summer chum management units and stocks. Population performance standards will be used to evaluate the effectiveness of all management actions in conserving and recovering summer chum (see also below, section 4.2.6).	WDFW, USFWS, Tribes		Phases 1 and 2	Immediate
3. Verify that assumed effects of habitat restoration projects on habitat are what was assumed.	Projects should include post-construction monitoring for specific effects on habitat or fish (e.g., changes in habitat configuration or function (such as expansion of salt marsh) and/or improved fish access to restored habitat) (Part Three, 3.4).	Local governments and agencies with jurisdiction	WDFW, Tribes and other interested parties.	Phases 1 and 2	As projects are implemented
Objective: Validate critical assumptions behind planning and actions.					
1. Verify that under present guidelines artificial production projects do not affect genetic diversity of natural populations.	Continue to collect genetic information on natural summer chum. Collect genetic information over time from selected artificial production programs to monitor any changes and compare with natural populations (Part Three, 3.2).	WDFW, USFWS, Tribes		Phases 1 and 2	Immediate
2. Verify that straying of hatchery summer chum out of watersheds of origin is at acceptably low levels.	Sample summer chum for marks during brood stocking operations. Also, sample summer chum carcasses for marks in watersheds of origin and in adjacent watersheds (Part Three, 3.2).	WDFW, USFWS, Tribes		Phases 1 and 2	Immediate
3. Verify that regulatory measures for Hood Canal terminal fisheries based on run timing will control summer chum exploitation levels to expected low levels.	Catches in terminal fisheries will be monitored and genetic samples will be taken (to separate summer from fall chum) so that run timing assumptions are verified or modified, and associated regulatory measures are also adapted as needed (Part Three, 3.5).	Tribes, WDFW		Phases 1 and 2	Immediate

Table 4.6 Monitoring and Evaluation - objectives, strategies and actions (continued).

Strategy/Action	Description	Jurisdiction/ Authority	Partners	Resources/ Funding	Time Frame
4. Investigate whether controlled Hood Canal terminal fisheries impacts on summer chum do not disproportionately affect one or more stocks.	Results of monitoring summer chum catch distribution and associated genetics sampling information would address this issue (Part Three, 3.5).	Tribes, WDFW		Phases 1 and 2	Immediate
5. Verify that pre-terminal fisheries exploitation rates fall within bounds stipulated for conservation based fishing regime.	Monitoring of within state pre-terminal fisheries to estimate exploitation rates is planned. Agreements will be sought with Canada to monitor fisheries with likely impact (Part Three, 3.5).	WDFW, Tribes		Phases 1 and 2	Immediate
6. Verify and increase understanding of habitat factors for decline identified in this initiative.	Evaluations should be made in selected locations of factors (and associated parameters) currently identified as negatively affecting summer chum. Included are assessments of storm flow runoffs and upland drainage patterns that affect peak flows, low flow and temperatures, LWD loading and channel stability affecting channel complexity and floodplain function, sediment delivery and routing, riparian forest condition, and subestuarine habitat condition (Part Three, 3.4).	WDFW, Tribes	Other agencies and interested parties.	Phases 1 and 2	As funding and resources become available.
Objective: Perform assessments that address additional identified information gaps.					
1. Plan and implement evaluation of Dungeness summer chum population	The Dungeness stock is known to exist in the Dungeness River but the abundance and condition of the stock is not known (Part One, section 1.7.2.1). An assessment of the population, including measurements of the distribution and levels of escapement, should be designed and implemented by the management agencies and tribes. The assessment should provide an understanding of the status of the stock and provide a basis for determining appropriate management actions.	WDFW, and Tribes	USFWS and other interested agencies and parties	Phase 2	As soon as funding is available.

Table 4.6 Monitoring and Evaluation - objectives, strategies and actions (continued).

Strategy/Action	Description	Jurisdiction/ Authority	Partners	Resources/ Funding	Time Frame
2. Assess summer chum productivity and production capacity.	Obtain age and sex data from existing populations and develop estimates of productivity. Also perform more in depth investigations; for example, the research project has been initiated at Big Beef Creek (where summer chum are being reintroduced) to assess productivity from egg deposition to adult return and to follow production of consecutive generations spawning in the stream (Part Three, 3.2).	WDFW	Tribes, HCSEG and other interested parties.	Phases 1 and 2	Continuing.
3. Assess summer chum non-harvest mortality.	Research non-harvest summer chum mortality as a mortality rate per fish encountered such that the rate for each gear type is estimated with sufficient precision to match goals for accuracy of exploitation rate estimates and management effectiveness (Part Three, 3.5).	WDFW, Tribes		Phase 2	When funding becomes available.
4. Develop stream habitat classification system and database.	The Salmon and Steelhead Habitat Inventory and Assessment Project (SSHIAP) is being developed by the co-managers and is expected to provide recovery planners a valuable tool for planning and prioritizing protection and recovery work (Part Three, 3.4).	Tribes, WDFW	Other agencies and interested parties.	Phases 1 and 2	Continuing.
5. Survey habitat in streams and estuaries where little or no data has been collected.	Systematically collected habitat data is lacking or limited in scope for several streams and the nearshore estuarine areas. Surveys will provide improved understanding of habitat conditions affecting summer chum (Part Three, 3.4).	WDFW, Tribes	Other agencies and interested parties.	Phase 2	When funding or resources become available.
6. Assess stream bed scouring effects on summer chum redds in selected watersheds.	Increases in peak winter flows, stream bed mobility and consequent scouring of salmon redds is perceived as a major factor of decline in several watersheds. Scour chain monitoring linked with spawning surveys and/or emergent fry trapping will help better define severity of effect on summer chum (Part Three, 3.4).	WDFW, Tribes	Other agencies and interested parties.	Phase 2	When funding or resources become available.
7. Perform multi-scenario analysis of full build-out in selected watersheds using standard and alternative designs and materials.	Analysis will help reconcile development pressures with habitat protection needs (Part Three, 3.4).	Counties, local governments	WDFW, Tribes	Unknown	As soon as practical.

Table 4.6 Monitoring and Evaluation - objectives, strategies and actions (continued).

Strategy/Action	Description	Jurisdiction/ Authority	Partners	Resources/ Funding	Time Frame
8. Perform analysis of hydrologic changes in selected watersheds.	Hydrologic changes such as artificial stream channel constrictions and increased peak flows dynamically interact to affect sediment regimes, bed stability and channel complexity impacting summer chum habitat. Analysis of these changes will help focus on appropriate summer chum protection and recovery measures (Part Three, 3.4).	Counties, local governments	WDFW, Tribes	Unknown	As soon as practical.
9. Inventory and assess estuarine nearshore habitat and shoreline structures.	Little information currently exists on estuarine nearshore habitat or shoreline structures. A study is needed to survey the shoreline and evaluate effects of man-made structures on habitat and summer chum (Part Three, 3.4).	WDFW, Tribes	Other agencies and interested parties.	Phase 2	When funding or resources become available.
10. Perform estuarine life history study of selected summer chum populations.	Study would be to determine the distribution and timing, as well as the feeding and sheltering characteristics of juvenile summer chum in the subestuarine and nearshore environments (Part Three, sections 3.3, 3.4).	WDFW, Tribes	Other agencies and interested parties.	Phase 2	When funding or resources become available.

4.2.6 Program Integration and Adaptive Management

The summer chum salmon conservation initiative is an integrated plan, with each element contributing in concert with other elements to address the broad range of factors for decline and promote recovery. The plan elements of artificial production, ecological interactions, habitat and harvest management have been presented separately, each with specific objectives, strategies and actions intended to conserve and recover summer chum salmon. However, it is understood that the combination of effects from the individual strategies and actions, across all elements, is the key to success. To fully integrate the initiative's elements, the results must be assessed over time with existing management measures either adjusted or terminated, and possibly new measures added as is appropriate. While the previous descriptions of each of the elements address specifically applicable performance evaluations, the ultimate measure of overall success must include assessment of summer chum population performance. Table 4.7 describes the co-managers' approach to assessing and responding to summer chum population performance.

Table 4.7 Program Integration and Adaptive Management - objectives and action items.

Objective: Define population performance criteria for periodic evaluation of summer chum populations.

Strategy/Action	Description	Jurisdiction/ Authority	Partners	Resources/ Funding	Time Frame
1. Identify thresholds below which summer chum management units and stocks are at critical status.	Numerical critical thresholds or flags have been set for escapements and run sizes of management units and stocks (see Part One, 1.7.3 and Appendix Report 1.5).	WDFW, Tribes	NMFS	Phase 1	Completed as part of this initiative.
2. Identify recovery thresholds.	Numerical recovery thresholds are to be determined in 2000.	WDFW, Tribes	NMFS	Phase 1	Scheduled for completion in spring 2000.
Objective: Periodically evaluate summer chum population performance and provide effective management response to evaluation.					
1. Annually review population performance and provide specified response.	Review entails comparing past year's estimates of run sizes or escapements (for the defined management units and stocks) with identified critical threshold values. If any estimates fall below critical thresholds or flags, the following responses are implemented: 1) identify and if appropriate implement appropriate emergency actions; 2) within 6 months, prepare assessment of causes of population decline and recommend modifications to plan to effect prompt restoration of management unit or stock to non-critical status. All potential factors for decline will be considered in assessment.	WDFW, Tribes	NMFS and other interested parties.	Phase 1	Annual
2. Review population performance every 5 years.	Five year review will include: 1) performance review of each element of plan relative to its specific existing and any subsequent newly defined standards, 2) cumulative and comprehensive review of annual population performances relative to critical thresholds, 3) refinement of recovery standards if sufficient information is available, and 4) preparation of recommendations pertaining to management objectives, strategies and actions including possible modification or termination of existing measures and addition of new ones. Management actions will be pursued based on recommendations.	WDFW, Tribes	NMFS and other interested parties.	Phase 1	Every five years beginning 2004.

4.3 Accomplishing Goals of Recovery Plan and Meeting ESA Objectives

The Summer Chum Salmon Conservation Initiative comprehensively addresses all factors affecting the decline of summer chum salmon in Hood Canal and Strait of Juan de Fuca. Specific actions and strategies are identified to protect and restore the populations and, because there is much to learn about summer chum and the effectiveness of management actions taken, adaptation based on knowledge gained is a part of the plan. Over time, learning as we go, the co-managers believe that recovery of the summer chum will be realized.

4.3.1 Achieving the Recovery Plan Goal

Recovery activities for Hood Canal and Strait of Juan de Fuca summer chum salmon were begun by the co-managers in 1992. The recovery goal was, and still is, to return summer chum salmon to full health and to allow future harvests. This goal is in some respects more rigorous than the requirements of ESA, since it goes beyond the singular need to secure summer chum populations from the risk of extinction. The plan goal statement is presented below and is discussed in the Foreword (page 2).

The goal of the Summer Chum Salmon Conservation Initiative is:

To protect, restore and enhance the productivity, production and diversity of Hood Canal summer chum salmon and their ecosystems to provide surplus production sufficient to allow future directed and incidental harvests of summer chum salmon.

The co-managers believe that there is a very high likelihood that this plan will accomplish the recovery of Hood Canal and Strait of Juan de Fuca summer chum stocks. The recovery objectives and actions identified for artificial production, ecological interactions, and harvest management will be immediately implemented by the co-managers (most are already underway). The implementation of strategies for habitat recovery is necessarily an activity that is longer term and will involve participants other than just the co-managers. The following elements of the plan will contribute to its ultimate success.

4.3.1.1 Artificial Production

The plan identified 16 individual summer chum stocks, seven of which have recently become extinct (Part One). The co-managers are committed to seeing that no additional extinctions occur. Annual assessments of individual stocks will determine levels of extinction risk, and if any stock is found to be at great risk, hatchery

"The co-managers are committed to seeing that no additional extinctions occur."

supplementation using local brood stock will be used to sustain and recover the stock. The hatchery supplementation techniques to be applied under this plan have been proven to be extremely successful for the Big/Little Quilcene and Snow/Salmon summer chum salmon stocks, and if needed can confidently be used in the future. In addition to the supplementation of at risk extant stocks, the plan provides for the staged reintroduction of summer chum salmon to streams where recent extinctions have occurred. Two such projects are currently underway, at Big Beef and Chimacum creeks, and the first three-year old spawners are expected back in 1999. These and future reintroductions will further reduce the overall extinction risk to summer chum salmon by increasing the number of independent populations.

4.3.1.2 Ecological Interactions

Two significant sources of negative competition and/or predation were identified in Part Two - Region-wide Factors For Decline, interactions with hatchery salmonids and predation on adult summer chum by marine mammals. The co-managers will institute rigorous criteria for the release of hatchery salmonids into the waters of the Hood Canal and Strait of Juan de Fuca regions. These criteria include time, size and species restrictions that are designed to greatly reduce potential negative impacts on summer chum salmon. The co-managers will monitor and evaluate risk aversion measures being implemented to meet these criteria. The plan recommends that the on-going studies of harbor seal predation on summer chum salmon continue, and recognizes that future remedial measures may be required if seal predation is shown to be affecting recovery.

> ***"The co-managers will institute rigorous criteria for the release of hatchery salmonids into the waters of the Hood Canal and Strait of Juan de Fuca regions."***

4.3.1.3 Habitat

Habitat degradation was identified as a major factor for decline (Part Two). Recovery of proper habitat quality and function is a long term effort. The habitat portion of the plan cannot be implemented by the co-managers, but rather is the responsibility of land and water management agencies, major land holders, and private citizens. The summer chum plan has identified watershed and estuarine limiting factors and measures for recovery, however, the identification of specific actions, prioritization, and implementation are a part of an on-going process to be completed by the jurisdictions actually controlling the habitat.

> ***"... the identification of specific actions, prioritization, and implementation are a part of an on-going process to be completed by the jurisdictions actually controlling the habitat".***

4.3.1.4 Harvest Management

The harvest of summer chum salmon in various terminal and pre-terminal fisheries was identified as one of the factors contributing to the decline of summer chum stocks. The co-managers will limit the incidental summer chum harvests in Washington terminal and pre-terminal fisheries to levels that will minimize impacts on summer chum stocks. Annual evaluation and adaptive management of the fisheries will assure that the numbers of summer chum salmon that are harvested incidentally to fisheries for other species remain at very low levels.

> ***"The co-managers will limit the incidental summer chum harvests in Washington terminal and pre-terminal fisheries to levels that will minimize impacts on summer chum stocks."***

4.3.1.5 Cumulative Effects of Recovery Actions

Taken together, the above described conservation and restoration activities will have a synergistic effect on the recovery of Hood Canal and Strait of Juan de Fuca summer chum stocks. In summary, the following results are expected. No further extinctions will occur. Re-introductions of summer chum to currently unpopulated streams will occur through time. The past negative consequences potentially resulting from hatchery fish interactions will be largely eliminated as a precautionary measure. The impacts of incidental fishery harvests on summer chum stocks will be minimized. Habitat, both freshwater and estuarine, will be gradually returned to a more productive state. Annual monitoring and evaluation and adaptive management will assure that recovery objectives are achieved. Ultimately, the combined effects of these actions will recover summer chum salmon.

4.3.2 Meeting ESA Objectives

In 1996, NMFS published a document titled "Coastal Salmon Conservation: Working Guidance for Comprehensive Salmon Restoration Initiatives on the Pacific Coast". The purpose of this guidance was to identify the elements that would constitute a successful salmon recovery plan. NMFS described three major criteria to be met by a conservation plan (NMFS 1996a). One criterion is that the plan must have substance; that is, it includes measures that will effect recovery. Another criterion is that there must be certainty that the measures will be undertaken by the parties with the authority and means to implement recovery actions. The third criterion is for monitoring and assessment that will lead to effective adaptive management and help determine what recovery is and when it occurs. This initiative provides the basis for addressing all three criteria.. However, in order to meet the three criteria and succeed in recovering summer chum, the measures summarized in the following sections must be addressed by the indicated parties. As implementation of the below described strategies actions occur, the participants in recovery can learn from the experience, making adjustments as appropriate. Furthermore as information is gained, the conditions of recovery may be determined and ultimately recovery of the summer chum can be achieved.

The 1996 NMFS guidance document also presented nine critical and desirable elements that should constitute a salmon restoration strategy for an ESA listed Evolutionarily Significant Unit (ESU).

4.3.2.1 NMFS - Critical and Desirable Elements

Substance of the Plan

1. Identify at appropriate scales the major factors that have contributed to decline of the ESU.
2. Establish priorities for action.
3. Establish explicit objectives and timelines for correcting factors for decline and achieving desired population characteristics.
4. Establish quantifiable criteria and standards by which progress toward each objective will be measured.
5. Adopt measures (actions) needed to achieve the explicit objectives.

Implementation Certainty

6. Provide high levels of certainty that the identified measures and actions will be implemented, including necessary authorities, commitments, funding, staffing, and enforcement measures.

Monitoring

7. Establish a comprehensive monitoring and reporting program, including methods to measure whether objectives are being met, and to detect subpopulation declines and increases in each ESU.

Other

8. As much as possible, integrate Federal state, tribal, local, corporate, and non-governmental activities and projects that are designed to recover salmon populations and the habitats upon which they depend.
9. Utilize an adaptive management approach that actively shapes management actions to generate needed information.

4.3.2.2 NMFS Elements and the Summer Chum Plan

Those recovery actions that will be implemented by the co-managers are in the areas of artificial production, ecological interactions, and harvest management. Each of the NMFS recovery plan elements is discussed below in the context of the co-managers' responsibility and their implementation of recovery actions. Habitat recovery actions should also eventually be incorporated under the NMFS recovery plan elements but are not included in the following discussion because they fall primarily outside the co-managers' jurisdiction.

Substance of the Plan

Element 1) Identify at appropriate scales the major factors that have contributed to decline of the ESU.

Region-wide factors contributing to the observed summer chum salmon declines in Hood Canal and Strait of Juan de Fuca were identified in Part Two - Region-wide Factors For Decline of this recovery plan. Major factors for decline for Hood Canal stocks were habitat deterioration and terminal area fishery harvest, and moderate impacts resulted from climate effects on stream flow, interactions with hatchery salmonids, and pre-terminal harvests. Strait of Juan de Fuca summer chum stocks experienced major cumulative habitat impacts and climate effects on stream flow, along with moderate impacts from pre-terminal harvest. The recent expansion of harbor seal populations and their predation on summer chum was identified as a recent major factor that may affect recovery.

Limiting factors for summer chum salmon at the stock, watershed, and management unit levels are assessed in Part Three - Evaluation and Mitigation of Factors for Decline, which identifies specific limiting factors and also provides specific strategies and actions for recovery.

Element 2) Establish priorities for action.

For those management actions that are the responsibility of the co-managers (including artificial production, ecological interactions, and harvest management) , the recovery plan has adopted a single priority: **immediate action**. In fact, substantial co-manager actions in these areas have been underway since 1992, and have resulted in increased summer chum salmon runsizes and escapements in recent years (see discussions in Parts One and Three).

Element 3) Establish explicit objectives and timelines for correcting factors for decline and achieving desired population characteristics.

Specific objectives are identified in detail in the artificial production, ecological interactions, and harvest management discussions in Part Three, and are summarized above in section 4.2. Each objective has one or more specific actions that address recovery needs. Specific timelines are not identified for the various objectives and actions because immediate implementation is the co-manager intent (see Element 2 above). In some situations, future actions may be instituted based on currently unforeseeable circumstances, e.g. supplementation of a stock that declines to a point of extinction risk, or an opportunity for reintroduction to a former summer chum stream. Adaptive management is also a major feature of the plan (see Element 9 below), however, since, changes in management will be in response to future events and results, no timelines can be established.

Element 4) Establish quantifiable criteria and standards by which progress toward each objective will be measured.

Very specific and quantifiable criteria and standards for management and implementation of recovery objectives are presented in the individual sections of Part Three, and are summarized below. Some examples of specific criteria include; brood stock collection criteria to avoid loss of

genetic variability, time and size at release criteria for hatchery salmon to avoid competition and predation effects on summer chum, and exploitation rate criteria to minimize fishery impacts. In addition, the plan contains three approaches for evaluating the abundance, distribution, and extinction risk for summer chum stocks.

Element 5) Adopt measures (actions) needed to achieve the explicit objectives.

Individual action items (relating to specific objectives) are presented in the artificial production, ecological interactions, and harvest management sections of Part Three, and are summarized above (section 4.2). Many of the actions have been previously implemented and will be continued, while others represent new recovery activities.

Implementation Certainty

Element 6) Provide high levels of certainty that the identified measures and actions will be implemented, including necessary authorities, commitments, funding, staffing, and enforcement measures.

The co-managers are the lawfully designated agencies (under US v. Washington and State statutes) with the responsibility for managing summer chum salmon. Co-manager recovery activities have been underway since 1992, and as a result, many of the objectives of this plan have been included in the normal operation of WDFW and the Tribes. Management biologists, hatchery personnel and facilities, and enforcement officers are routinely assigned to the activities affecting summer chum salmon. The co-mangers feel that current dedicated levels of funding and staffing are minimally acceptable to effect summer chum salmon recovery. However, additional activities are identified in the plan, the funding and implementation of which, will improve summer chum salmon management and likely speed recovery. Important new measures include support of supplementation and reintroduction projects, collection of information on productive capacity and recovery levels, and the monitoring and evaluation of recovery actions.

Monitoring

Element 7) Establish a comprehensive monitoring and reporting program, including methods to measure whether objectives are being met, and to detect subpopulation declines and increases in each ESU.

The co-managers have a number of long term monitoring programs in place that are adequate to measure general population responses to recovery efforts. These include spawner escapement monitoring, harvest accounting, run size estimation procedures, and hatchery release accounting. The plan identifies specific ways that these existing programs can be improved. In addition, needed new monitoring and evaluation action items are identified in Part Three (and see above summary in section 4.2.5). Some examples are; collection of comprehensive age data for use in determining production rates for summer chum stocks, genetic stock identification in fisheries to help minimize selective impacts, evaluation of the success of supplementation programs, and monitoring of straying of supplemented stocks. While the existing co-manager monitoring and evaluation programs are

sufficient to achieve the long range recovery goals of this plan, the recommended new monitoring efforts will allow more protective and directed recovery approaches and will ultimately speed recovery.

Other

Element 8) As much as possible, integrate Federal state, tribal, local, corporate, and non-governmental activities and projects that are designed to recover salmon populations and the habitats upon which they depend.

This recovery plan is the combined effort of technical staff members representing the co-managers (WDFW and The Point-No-Point Treaty Tribes), and representatives of NMFS and USFWS. Additionally, private citizen salmon enhancement groups were provided opportunities to meet with the co-managers and to offer comments on plan elements affecting their projects. As the plan proceeds, there will be opportunities for general public comment on all parts of the recovery effort.

Element 9) Utilize an adaptive management approach that actively shapes management actions to generate needed information.

Adaptive management is a critical element of the recovery plan for summer chum salmon. Annual and longer term evaluations of the abundance, distribution, and extinction risk of summer chum stocks will guide the future application of the recovery activities under this plan. At the same time, monitoring and evaluation programs will evaluate the effectiveness of individual recovery efforts like supplementation and reintroduction, fishery impacts, and seal predation. These evaluation and adaptive management approaches are described in Part One, 1.7 Stock Evaluations, and in Part Three, 3.6 Program Integration and Adaptive Management (see also summary in section 4.2.6 below).

4.4 Population-based Recovery Goals

The following sections describe how the overall goal to protect and restore summer chum is to be achieved and summarize measures to be taken to meet that goal. However, specific quantitative, population-based recovery goals are also needed that determine when recovery has been achieved. These goals must account for the condition and dynamics of the summer chum populations and should define recovery in terms of population abundance, productivity and diversity. For a given population, management unit or all of the summer chum to be recovered, goals specified as levels or ranges of summer chum abundance (run size) and escapement must be specified, consistent with the productive capacity of the habitat. Lacking adequate information on the relationship of habitat to productive capacity, historical experience with populations may initially serve to set the abundance and escapement recovery goals.

But in addition to defining abundance and escapement recovery goals, it is critical to determine productivity goals; that is, target production rates or ranges of rates. Productivity can be thought of as a rate of survival; that is, the number of salmon produced for each parent spawner that survive

over a given life stage or range of life stages. Productivity may be measured, for example, over the entire life cycle as the number of recruits per spawner. Productivity determines the amount of harvest a given population can support and it determines the resiliency of that population; that is, it's ability to recover and to sustain itself under a range of environmental conditions. For a population to be considered recovered, it should demonstrate adequate productivity for sustainability and harvest, as defined by the productivity recovery goals.

Finally, population-based recovery goals must include diversity. This set of goals should include maintaining the geographic range and variable life histories expressed by the populations of summer chum. To a large extent this consideration is already addressed in this recovery plan with the focus first on protecting and restoring existing populations, but also on restoring summer chum to watersheds where they are now extinct.

The co-managers have defined performance standards upon which to measure the progress of the summer chum salmon populations towards achieving recovery (see section 3.6.4). In addition, the co-managers are developing a comprehensive set of population-based recovery goals, addressing abundance, productivity and diversity as described above. These recovery goals are scheduled for completion in spring 2000 and will be made available in a supplement to this recovery plan (see section 4.6, Plan Supplements).

4.5 Plan Implementation

The above summary descriptions of objectives, strategies and actions for summer chum protection and recovery include listings of the participants with the authority or jurisdiction to pursue specific actions or strategies and also listings of other participants who can provide support as partners. The fisheries co-managers, Washington Department of Fish and Wildlife and Point No Point Treaty Tribes, are committed to carrying out the provisions of the plan for which they have the authority (measures addressing harvest management, artificial production and ecological interactions) and to supporting other parties who pursue recommendations of the plan for which they have jurisdiction or authority (e.g., counties in their efforts to address habitat protection and recovery measures). The co-managers have, in fact, since 1992 been implementing many of the actions specified in this initiative. The process of developing the initiative has confirmed and refined many of the co-managers' existing management measures and led to the development and immediate implementation of others. The co-managers intend to file this initiative with the federal court to be adopted as a court order under U.S. v Washington.

The preparers of this plan have attempted to develop a comprehensive document that addresses all the components for protection and recovery of summer chum and provides a scientific basis for recommending actions/strategies. However, particularly with respect to summer chum habitat, this plan is only the first step to a larger planning and implementation effort that must continue if recovery of the summer chum is to succeed. Counties and other agencies, who have not participated in the development of this plan but have provided review comments during its development, are encouraged to address the recommended strategies and actions that fall under their jurisdiction or authority. This will lead to additional planning, that will result in definition and execution of

specific protection and recovery actions. The support of landowners, private non-profit organizations, volunteer groups and local citizens is also important if these efforts are to succeed.. The co-managers will offer technical support in how to interpret and apply the recommendations of this plan.

The basic requirements for the harvest management, artificial production and ecological interaction components of the plan are currently being met by resources and funding available to WDFW, the Tribes and USFWS. These include: 1) the annual planning, regulation, monitoring and enforcement of fisheries and also, monitoring of harvests and escapements; 2) the operation, basic assessments and monitoring of supplementation and reintroduction projects; and 3) all of the mitigative measures to prevent or reduce ecological impacts on summer chum from potential hatchery-caused ecological interactions. All of these currently supported actions/strategies are categorized in the tables above as Phase 1, meaning that funding and resources to execute the measures are presently in place. There are, however, several actions under jurisdiction of the fisheries co-managers that are categorized as Phase 2 or a combination of Phases 1 and 2, meaning the actions are not funded or could be improved with additional funding. Development of the needed support of these actions is strongly recommended to speed recovery. Still, given the existing available resources and funding, the co-managers' believe the summer chum conservation requirements under their jurisdiction are being met.

Many of the recommended habitat-related strategies and actions are not currently funded (Phase 2 in Tables 4.4 and 4.5). As previously noted, additional participation in planning is expected to result in the specification of habitat protection and restoration measures for which funding will need to be found. On-going and new funding sources through the county, state and federal governments as well as voluntary participation by citizens, landowners and others can help to meet the requirements for funding and implementation of these measures.

It is expected that the measures identified in this plan and that are subsequently developed based on recommendations of the plan will be incorporated into the ESA permitting process. That process has been in development in the same time frame as this plan. There may be a need to adapt or modify measures within the plan in response to the permitting requirements (i.e., under ESA sections 4 (d), 7 or 10).

4.6 Plan Supplements

Two additional reports have been published to provide supporting information for this initiative: Supplemental Report No.1 - Revised Estimates of Escapement of Hood Canal and Strait of Juan de Fuca Natural Spawning Summer Chum Populations (Haymes 2000), and Supplemental Report No.2- Public Review Comments on Draft Habitat Sections of the Summer Chum Salmon Conservation Initiative (PNPTT and WDFW 2000). The first supplement provides a detailed description of results from an intensive review of the escapement data, including revised estimates of annual summer chum salmon escapements and ratings of the quality of the estimates. Supplemental Report No.2 is a compilation of all written comments received from distribution of a draft of the habitat element of the initiative (section 3.4) in March, 1999. Additional supplemental reports to the initiative will

prepared in the course of its implementation. A third supplement describing population-based summer chum salmon recovery goals is scheduled for completion in spring 2000. Later this year, another supplement comprising the results of the first annual plan review will also be made available.

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Glossary

Definitions (acronyms and abbreviations follow).

Acclimatization - A juvenile fish rearing and release process applied to promote adaptation and imprinting of a fish stock to the environmental and geographic parameters of its home watershed, or desired watershed for adult return.

Aggradation - The accumulation of sediment in a river channel resulting from changes in flow, sediment inputs, or changes to the adjacent floodplain.

Alevin - Newly hatched salmonids which remain in gravel until their yolk sacs have been resorbed.

Allele - One of two or more alternate forms of a gene.

Alluvial - Originating from the transport and deposition of sediment by running water.

Anadromous fish - Fish that are born in freshwater, migrate to the ocean to grow and mature, and return to freshwater as adults to reproduce.

Area Under the Curve (AUC) - An escapement calculation methodology that converts the area under a spawner abundance curve to a total fish estimate.

Artificial propagation - Any assistance provided by human technology to animal reproduction. In the context of Pacific salmonids, this assistance includes (but is not necessarily limited to) spawning and/or rearing in hatcheries, captive broodstock projects, or the use of remote site incubators.

Base Conservation Regime (BCR) - The management of the harvests of summer chum salmon at population levels that provide incremental increases in escapements and are above critical population thresholds.

Best Management Practices (BMP) - State-of-the-art environmental protection measures.

Biodiversity - The variety and abundance of species, their genetic composition, and the natural communities, ecosystem, and landscapes in which they occur.

Boldt Decision - See *U.S. v. Washington*.

Broodstock - Those adult salmonids that are destined to be the parents for a particular stock or smaller group of fish.

Bulkhead - A structure or wall constructed in or above the intertidal zone to prevent shoreline erosion from wave action.

Canadian Department of Fisheries and Oceans (CDFO) - The national fishery management agency of Canada.

Carrying Capacity - The maximum number of individuals or biomass of a given species or complex of species of fishes that a limited and specific aquatic habitat may support during a stated interval of time.

Cascade - A series of small steep drops increasing the velocity of the stream.

Catch - The act of landing a fish at which point the fisher has the option of release or retention.

Catch Record Card (CRC) - A data recording system for recreational salmon fisheries that requires that anglers record all sport caught salmon on a "punch" card, by species, date, and location of harvest.

Channelized - A portion of a river channel that has been enlarged or deepened, and often has armored banks.

Channel processes - The interaction of elements that form river habitat including riparian vegetation, large woody debris, sediment delivery, and hydrology.

Channel migration zone - The area occupied by a stream channel under existing climate conditions, approximated by the 100 year floodplain, side channels and low terraces of a river.

Co-managers - The Hood Canal and Strait of Juan de Fuca salmon co-managers are thePoint-No-Point Treaty Tribes including: the Skokomish Tribe, the Port Gamble S'Klallam Tribe, The Jamestown S'Klallam Tribe, and the Lower Elwha Klallam Tribe; and the Washington State Department of Fish and Wildlife**.**

Composite stock (population) - A stock sustained by both wild and artificial propagation.

Conspecific - Individuals of the same species.

Convention waters

Critical Abundance Threshold (CAT)

Critical Escapement Threshold (CET)

Critical stock - A stock of fish experiencing production levels that are so low that permanent damage to the stock is likely or has already occurred.

Cubic feet per second (cfs) - A measurement of stream flow.

Cultured stock - A stock that depends upon spawning, incubation, hatching, or rearing in a hatchery or other artificial production facility.

Cumulative effect - A change to the environment caused by multiple, incremental impacts interacting with natural ecosystem processes. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time.

Decommission (a road) - To remove those elements of a road that reroute hillslope drainage and present slope stability hazards.

Deep-water - Defined in terms of habitat use by summer chum, deep-water habitat includes those areas greater than 2 meters in depth (6.5 feet, relative to mean lower low-water) used by larger summer chum juveniles for feeding and out-migration and by adults during their return migration.

Delta - An alluvial landform, typically triangular in shape, composed of sediment at a river mouth that is shaped by river discharge, sediment load, tidal energy, land subsidence, and sea-level changes.

Dendrogram - A graphic summary of the genetic relationships among populations. The horizontal distance at which the stock branches connect indicates the degree of similarity/dissimilarity. The longer the distance at which the branch points connect, the greater the average genetic differences among stocks.

Depensatory Mortality - Mortality is depensatory when its rate (i.e., proportion of population affected) increases as the size of the population decreases. This is in contrast to compensatory mortality where the mortality rate decreases as the population size decreases.

Depressed stock - A stock of fish whose production is below expected levels based on available habitat and natural variations in survival levels, but above the level where permanent damage to the stock is likely.

Detritus - Litter formed from fragments of organic material (leaves, animal wastes, carcasses, etc.).

Diameter at breast height (dbh) - The diameter of a tree, measured 4.5 feet above the ground on the uphill side of the tree.

Dispersal - The movement of plants and animals from one habitat to another. Juvenile chum disperse from freshwater to subestuaries, then onto nearshore and finally deep-water marine areas.

Drift cell - A discrete shoreline segment that, in an unaltered state, allows for the uninterrupted movement of beach materials. A drift cell includes a sediment source (such as a "feeder bluff"), a driftway along which the sediment moves, and a sink or site of deposition.

Drift gillnet - A gillnet of single web construction, not anchored, tied, staked, placed, or weighted in such a manner that it cannot drift (WAC 220-16-040).

Ecological interaction - The sum total of impacts of one species on another species, or on other members of the same species.

Ecosystem - A complex of biological communities and environment that forms a functioning, interrelated unit in nature.

Eelgrass - A flowering plant (*Zostera spp.*) that grows underwater in shallow estuarine and marine areas and that has long, grass-like leaves.

Effective population size (N_e) - The effective number of breeders per year times generation length. This can be calculated for summer chum salmon as; N_e = Average escapement times 0.2 (N_e/N, the proportion of the population assumed to effectively breed), times 3.6 (generation length) where 3.6 is the average age of Hood Canal summer chum salmon.

Electrophoresis - A process whereby charged molecules (such as DNA and enzymes) are separated in an electric field.

El Niño-Southern Oscillation (ENSO) - A climate event that begins as a warming episode in the tropical Pacific zone that can result in large scale intrusions of anomalously warm marine water northward along the PNW coastline.

Emergence - When newly-hatched salmonids that have fully absorbed their yolk-sac, they emerge from the gravel and promptly migrate downstream to estuaries.

Endangered Species Act (ESA) - A 1973 act of congress that mandated that endangered and threatened species of fish, wildlife, and plants be protected and restored.

Escapement - The number of adult fish returning to a stream that escape mortality from harvest and natural attrition, and comprise a spawning population.

Escapement Distribution Flag (EDF) - An escapement benchmark for checking the deviation of any one stock's escapement from the overall pattern of escapement within the stock's management unit.

Escapement goal - A predetermined biologically derived number of salmonids that are not harvested and will be the parent spawners for a wild or hatchery stock of fish.

Estuarine landscape - The mosaic of deepwater, nearshore, and subestuarine delta environments used by summer chum as they feed, rear, and migrate through Hood Canal and the eastern Strait of Juan de Fuca.

Evolutionarily Significant Unit (ESU) - NMFS definition of a distinct population segment (the smallest biological unit that will be considered to be a " species" under the Endangered Species Act). A population will be is considered to be an ESU if 1) it is substantially reproductively isolated from other conspecific population units, and 2) it represents an important component in the evolutionary legacy of the species.

Exploitation rate - The proportion of a returning run or total population of salmonids that is taken by fisheries.

Extinction - The loss of a stock of fish from its original range, or as a distinct stock elsewhere. Individuals of the same species may be observed in very low numbers, consistent with straying from other stocks.

Extinct stock - A stock of fish that is no longer present in its original range, or as a distinct stock elsewhere. Individuals of the same species may be observed in very low numbers, consistent with straying from other stocks.

Extirpation - The elimination of a species from a particular area.

Extreme terminal fishing (management) area - Marine or freshwater areas where salmonids of a single stock or management unit have separated from fish of other stocks.

F_1 - A genetic term representing first generation individuals reulting from a given cross or breeding.

F_2 - The second generation resulting from the interbreeding of F_1 individuals.

Feeder Bluff - An eroding shoreline bluff that supplies sediment to beaches via longshore drift.

Fingerling - Juvenile salmonids up to nine months of age and generally two to four inches in total length.

Fishery - The process of attempting to catch fish, which then may be retained or released.

Fitness - The relative ability of an individual (or population) to survive and reproduce in a given environment. The 'fit' of an organism to its environment.

Floodplain - The part of a river valley composed of unconsolidated river deposits that periodically floods. Sediment is deposited on the floodplain during floods and through the lateral migration of the river channel across the floodplain. The 100-year floodplain refers to that area of a river valley that is inundated during a large-magnitude flood occurring, on average, once every one hundred years.

Forest Ecosystem Management Assessment Team (FEMAT) - A team of scientists organized by the federal government in 1993 to develop a management plan for federal lands and rivers within the range of the northern spotted owl.

Forest Practices Act - A Washington State statute establishing minimum standards for forest practices and providing for necessary administrative procedures and rules applicable to activities conducted on or pertaining to forests on both state-managed and private lands.

Fork length (FL) - A fish length measurement from the tip of the nose to the fork of the tail fin.

Fragmentation - The process of reducing the size and connectivity of habitats, especially with reference to their use and accessibility by animal species that must disperse through them.

Fry - Young salmonids that have emerged from the gravel and are up to one month of age or any cultured salmonid from hatching through fourteen days after being ponded.

Gear limits - Restrictions placed on sport or commercial fishing gear, which are used to control the take of fish.

Gene - A specific unit of genetic material (DNA) that encodes the information for a single genetic trait.

Genetic diversity - All of the genetic variation within a group. The genetic diversity of a species includes both genetic differences between individuals in a breeding population (=within-stock diversity) and genetic differences among different breeding populations (=among-stock diversity).

Genetic drift - Gradual change with time in the genetic composition of a continuing population resulting from the elimination of some genetic features and the appearance of others, and appearing to be unrelated to the environmental benefits or detriments of the genes involved.

Gene flow - The rate of entry of non-native genes into a population, measured as the proportion of the alleles at a locus in a generation that originated from outside of the population. Can be thought of as the genetically successful stray rate into a population. See also *stray rate* and *homing rate*.

Gene pool - The total variety and proportions of alleles within a population.

Genetic risk - The probability of an action or inaction having a negative impact on the genetic character of a population or species.

Genetic Stock Identification (GSI) - A method that can be used to characterize populations of organisms based on the genetic profiles of individuals. The GSI process consists of a series of steps: 1) collect selected tissues from a representative sample of individuals from the population(s) under investigation; 2) develop genetic profiles for the individuals in each population by conducting starch-gel electrophoresis and histo-chemical staining using tissue extracts; 3) characterize each population by aggregating the individual genetic profiles and computing allele frequency distributions; and 4) conduct statistical tests using the allele counts characterizing each population to identify significantly different populations.

Genome - The total genetic composition of an individual. The complete genetic information possessed by an organism.

Geographic Information System (GIS) - A computer mapping program.

Geomorphic processes - Landform-modifying processes such as erosion, mass-wasting, and streamflow.

Glide - A gently flowing, calm reach of shallow water in a stream.

Governor's Salmon Recovery Office - See *Salmon Recovery Office*.

Gradient - The amount of vertical drop a stream experiences over a given distance.

Habitat - An area that supplies food, water, shelter, and space necessary for a particular animal's existence.

Habitat complexity - Variations in stream or tidal flow, velocity, and depth arising from structural features like LWD, floodplain, or estuarine landforms that provide cover from predators, suitable gravel for spawning, sufficient food resources, dispersal corridors, and refuge from harsh physical or chemical conditions.

Habitat Conservation Plan (HCP) - A program for the long-term protection and benefit of a species in a defined area; required as part of a Section 10 incidental take permit application under the federal Endangered Species Act.

Harmonic mean - The reciprocal of the arithmetic mean of the reciprocals of a finite set of numbers; harmonic mean = $\frac{1}{\frac{1}{n}\sum \frac{1}{x_i}} = \frac{n}{\sum \frac{1}{x_i}}$

Harvest - Fish that are caught and retained in a fishery (consumptive harvest).

Harvest project - Projects designed for the production of fish that are primarily intended to be caught in fisheries.

Harvest rate - The proportion of the available numbers of salmonids that is taken by fisheries in a specific time period.

Hatchery fish - A fish that has spent some part of its life-cycle in an artificial environment and whose parents were spawned in an artificial environment.

Hatchery stock (population) - A stock that depends on spawning, incubation, hatching or rearing in a hatchery or other artificial propagation facility (synonymous with cultured stock).

Hatchery production - The spawning, incubation, hatching, or rearing of fish in a hatchery or other artificial production facility (e.g., spawning channels, egg incubation boxes, or pens).

Hazard - Undesirable events that an artificial propagation program is attempting to avoid.

Headwaters - The upper reaches of a stream or stream system.

Healthy stock - A stock of fish experiencing production levels consistent with its available habitat and within the natural variations in survival for the stock. This does not imply that the habitat itself is necessarily "healthy."

Heterozygosity - The proportion of individuals in a population that possess two different forms (alleles) of a single gene (locus).

Homing rate - Of all the fish from a population that successfully return to spawn, the homing rate is the proportion that return to spawn in the same population in which their parents spawned. See also *stray rate* and *gene flow*.

Hood Canal Coordinating Council (HCCC) - A council of governments formed under Washington State RCW 29.34 consisting of Jefferson, Kitsap and Mason counties, Port Gamble S'Klallam and Skokomish tribes, and with the support of federal and state agencies. Its mission is to coordinate actions that protect and restore the environment and natural resources of the Hood Canal basin. It also provides educational services to local communities.

Hood Canal Salmon Enhancement Group (HCSEG) - The HCSEG is one of twelve Regional Fisheries Enhancement Groups established by the Washington State legislature in 1991. Funds for projects and administration are provided through recreational and commercial salmon license sales, and salmon carcass sales from state hatchery facilities. Technical support for the group is provided by the WDFW Volunteer Program. The group is volunteer-based, and is active in salmonid enhancement and habitat improvement projects throughout the Hood Canal region.

Hood Canal Salmon Management Plan (HCSMP) - A state/tribal salmon management plan for the Hood Canal region adopted in 1986 as a part of U.S. v. Washington.

Hybridization - The interbreeding of fish from two or more different stocks or species.

Hydraulic Project Approval (HPA) - A WDFW permit that is required for construction and other work that uses, diverts, obstructs, or changes the natural flow or bed of fresh- or saltwaters of the state.

Hydraulics code - The primary authority that the Washington Department of Fish and Wildlife has to meet its goal of protecting fish and wildlife habitat. This code grants WDFW the authority to approve or deny requests by landowners to carry out activities that occur below the ordinary high-water line.

Hydrologic maturity - Condition of a forest stand in which hydrologic processes operate as they do in a mature or old-growth forest. In particular, snow accumulation is typically lower in thick, dense forest (at middle and lower elevations) than in openings, due to the melting of snow caught in the canopy between storms.

Impervious surfaces - Areas covered by buildings, roads, parking lots, and other hard structures which reduce or prevent infiltration of rain water thereby increasing runoff to streams which results in a greater magnitude and frequency of peak flow events.

Implementation monitoring - Monitoring done to determine whether conservation strategies are implemented as planned.

Imprinting - A juvenile fish rearing and release process applied in an artificial propagation program to promote recognition, and high fidelity, of returning adult fish to the watershed of release..

Inbreeding - The mating of related individuals.

Incidental harvest - The capture and retention of species other than those a fishery is primarily opened to target/take. It can also refer to marked fish of the same species.

Incubation - A salmon life stage prior to egg hatching during which embryos are developing in the gravel where they were spawned. After hatching young chum salmon remain in the gravel until their yolk-sacs are fully absorbed, then emerge and migrate to estuaries.

Independent tributary - A small stream flowing directly into marine waters.

Instream Flow Incremental Methodology (IFIM) - An analytical methodology for estimating the stream flows that will provide usable stream area for various salmonid life stages.

Integrated project - Project where artificially propagated fish are intended to spawn in the wild and become fully reproductively integrated into a particular natural population.

Intertidal zone - The area between the highest and lowest tidal levels.

Isolated project - Project where artificially propagated fish are not intended to spawn in the wild or be genetically integrated with any specific natural population.

Joint Natural Resources Cabinet (JNRC) - A committee made up of the directors of 13 Washington State natural resource agencies that promotes interagency communication, coordination, and policy direction on environmental and natural resource issues.

Landscape - A large regional unit of land or water that is composed of a mosaic of communities or ecosystems, each changing through time and affecting conditions at the larger landscape scale. See "estuarine landscape".

Large woody debris (LWD) - Logs, limbs, or root wads 4 inches or larger in diameter, delivered to river and stream channels from streamside forests (in the riparian or upslope areas) or from upstream areas. LWD provides streambed stability and habitat complexity. LWD recruitment refers to the process whereby streamside forests supply wood to the stream channel to replenish what is lost by decay or downstream transport.

Life history - The events that make up the life cycle of an animal including migration, spawning, incubation, and rearing. There is typically a diversity of life history patterns both within and between populations. Life history can refer to one such pattern, or collectively refer to a stylized description of the 'typical' life history of a population.

Locally adapted population - A population whose members have genetically based characteristics that increase their fitness in their local environment compared individuals that lack these characteristics.

Long Live The Kings (LLTK) - An independent, private, professional non-profit organization based in Seattle, Washington dedicated to the perpetuation and recovery of Washington salmonid populations. The group is active in salmon enhancement and habitat improvement projects throughout the Puget Sound region. LLTK is responsible for on-going summer chum supplementation projects on Lilliwaup Creek and the Hamma Hamma River in the Hood Canal region.

Longshore drift - The movement of sediment along a shoreline by water currents and waves breaking at an angle to the shore.

Loss - Loss refers to the consequences of a hazard occurring. In this risk assessment, losses are measured at the level of individual populations and (to some degree) the entire ESU.

Management Unit (MU) - A stock or group of stocks which are aggregated for the purpose of achieving a desired spawning escapement objective.

Maximum Sustained Yield (MSY) - The maximum number of fish from a stock or management unit that can be harvested on a sustained basis, measured as the number of fish that would enter freshwater to spawn in the absence of fishing after accounting for natural mortality.

Mean higher high water (MHHW) - A tidal elevation obtained by averaging each day's highest tide at a particular location over a period of nineteen years. It is measured from the MLLW = 0.0 tidal elevation.

Mean lower low water (MLLW) - A tidal elevation obtained by averaging each day's lowest tide at a particular location over a period of nineteen years. It is the tidal datum for vertical tidal references in saltwater areas.

Microcomputer Historic Catch and Landing Summary (MHCLS) - A tribal data base maintained by NWIFC.

Migrant (or stray) - An individual that breeds in a population other than that of its parents.

Migration - The seasonal movement of an animal from one area to another.

Migration rate (or stray rate) - The proportion of a population that consists of migrants.

Minimum Escapement Flag (MEF) - An escapement benchmark for checking if any stock's escapement is below a critical abundance threshold.

Minimum viable population (MVP) - The size of a population which, with a given probability, will ensure the persistence of the population for a specified period of time.

Mitigation - An action intended to reduce the adverse impact of a specific project or development.

Mixed-origin stock - A stock whose individuals originated from commingled native and non-native parents; or a previously native stock that has undergone substantial genetic alteration.

Mixed stock - A stock whose individuals originated from commingled native and non-native parents, and/or by mating between native and non-native fish (hybridization); or a previously native stock that has undergone substantial genetic alteration.

Mixed-stock fisheries - Any fishery that catches fish from more than one stock.

National Marine Fisheries Service (NMFS) - A branch of the National Oceanic and Atmospheric Administration, Department of Commerce whose responsibilities include administration of the endangered species act for anadromous and marine fish.

National Pollution Discharge Elimination System (NPDES) - A program under the federal Clean Water Act.

Native population - See *Native stock.*

Native species - A species of fish indigenous to Washington State.

Native stock - An indigenous stock of fish that has not been substantially impacted by genetic interactions with non-native stocks or by other factors, and is still present in all or part of its original range. In limited cases, a native population may also exist outside of its original range (e.g. in a captive broodstock program).

Natural fish - A fish that has spent essentially all of its life-cycle in the wild and whose parents spawned in the wild. Synonymous with *natural origin recruit (NOR).*

Natural Origin Recruit (NOR) - See *Natural fish.*

Natural population - See *Natural stock.*

Natural Return Rate (NRR) - The number of native, naturally produced fish spawning in on generation divided by the total number of naturally spawning fish (hatchery plus naturally -produced fish) in the previous generation.

Natural spawners (NS) - See *Natural fish.*

Natural stock - A stock that is sustained by natural spawning and rearing in the natural habitat.

Nearshore - Defined in terms of habitat use by summer chum, nearshore habitat includes intertidal and shallow sub-tidal areas (less than 2 meters or 6.5 feet in depth relative to mean lower low-water), and includes beaches, mud- and sandflats, eelgrass, kelp, and macroalgae beds used by smaller summer chum juveniles for feeding and migration.

Net pen - A fish-rearing enclosure used in lakes and marine areas.

Non-native stock (population) - A stock (population) that has become established outside of its original range.

Non-target population - Any natural populations that is not intended to be integrated with a particular artificial propagation program.

North of Falcon (NOF) - An annual pre-season salmon management process for fisheries occurring between Cape Falcon (Oregon) and the Canadian border.

North Olympic Salmon Coalition (NOSC) - NOSC is based in Hadlock, Washington, and is one of twelve Regional Fisheries Enhancement Groups established by the Washington State legislature in 1991. Funds for projects and administration are provided through sales of recreational and commercial salmon licenses, and salmon carcass sales from state hatchery facilities. Technical support for the group is provided by the WDFW Volunteer Program. NOSC is volunteer-based, and is active in salmonid enhancement and habitat improvement projects throughout the Strait of Juan de Fuca region, including the Salmon Creek summer chum supplementation and Chimacum Creek reintroduction programs, which are operated co-operatively with Wild Olympic Salmon and WDFW.

Northwest Indian Fisheries Commission (NWIFC) - Created in 1974 by treaty Indian tribes in western Washington, the commission's role is to assist the tribes in conducting orderly and biologically sound fisheries.

Nutrients - Chemical compounds derived from organic and inorganic sources which move through the soil, air, water, and living organisms. Many nutrients, such as carbon dioxide (CO_2), are essential for life but can become harmful to organisms in excessive quantities.

Off-channel area - Any relatively calm portion of a stream outside of the main flow.

Ordinary high water mark - A distinctive change in the character of soil, banks, and vegetation in the area adjoining a stream channel related to typical and yearly high flow events.

Pacific Decadal Oscillation (PDO) - A pattern of climate and ocean condition regimes occurring in the north Pacific Ocean (associated with the Aleutian low pressure system) that results in shifts in sea surface temperatures and plankton abundance on a decadal time scale.

Pacific Salmon Commission (PSC) - The Pacific Salmon Commission is the bilateral commission with responsibility for administering the PST.

Pacific Salmon Treaty (PST) - The Pacific Salmon Treaty, signed between the U.S. and Canada in 1985, governs salmon interceptions by each country.

Parties (to the recoverey plan) - The co-managers (the Point-No-Point Treaty tribes and WDFW) alnong with USFWS, and NMFS are "parties" to the recovery plan.

Peak flows - Extremely high winter-time flows which can cause excessive streambed scour and damage or destroy salmon eggs incubating in the gravel. Peak flows can become more severe as a result of an increase in impervious surfaces and a reduction of hydrologic maturity, both of which increase the rate of water delivery to stream channels.

Pieces per meter (pcs/m) - Refers to large woody debris in streams.

Pinniped - Marine mammals of the suborder *Pinnipedia*, including seals, sea lions, and walruses.

Piscivorous - Organisms that feed on fishes.

Point-No-Point Treaty Council (PNPTC) - An intergovernmental fisheries management agency serving the four Point No Point Treaty Tribes whose usual and accustomed fishing areas include Hood Canal and Strait of Juan de Fuca. See also Point No Point Treaty Tribes.

Point-No-Point Treaty Tribes (PNPTT) - Point-No-Point Treaty Tribes; including Jamestown S'Klallam, Lower Elwha Klallam, Port Gamble S'Klallam, and Skokomish.

Pool - A relatively deep, still section in a stream.

Population - Synonymous with the term *stock*.

Population Viability Analysis (PVA) - A statistical analysis that provides an estimate of the probability that a population will become extinct over a specific time frame.

Pre-terminal fishing (management) area - Marine waters where specific stocks (or groups of stocks) are mixed with fish returning to other regions. These areas for summer chum salmon include all marine waters of Admiralty Inlet, the Strait of Juan de Fuca, and the Pacific Ocean seaward of Hood Canal and Discovery, Sequim, and Dungeness bays.

Production type - The method of spawning and rearing that produced the fish that constitute a stock.

Productivity - A measure of a biological system's ability to supply organisms with energy and resources to feed, grow, and survive.

Puget Sound Salmon Management Plan (PSSMP) - A state/tribal salmon management plan for the Puget Sound region adopted in 1985 as a part of U.S. v. Washington.

Quilcene National Fish Hatchery (QNFH) - A fish culture station operated by the USFWS on the Big Quilcene River.

Recolonization - The reestablishment of a salmonid stock in a habitat that the species previously occupied.

Recovery project - Artificial production projects primarily designed to aid in the recovery, conservation or reintroduction of particular natural population(s).

Recruits - The total numbers of fish of a specific stock available at a particular stage of their life history.

Redd - A spawning site for a pair of salmon, where eggs are buried in gravels for incubation and hatching.

Regional fisheries enhancement group - One of 12 regional fisheries enhancement (volunteer) groups funded under recreational and commercial salmon license fees, allowed to do habitat enhancement projects plus rear and release salmon into state waters under the direction of WDFW.

Refugia - Areas where an animals can go to escape predation or unfavorable environmental conditions.

Remote Site Incubator (RSI) - A lightweight, dark colored plastic barrel incubator that employs plastic substrate (hatching medium), and can be sized to accommodate 5,000 to 125,000 eggs per incubator. They are used mainly for incubating chum salmon eggs.

Resident fish - A life history type in which all life stages (e.g. spawning, rearing, growth, maturation) occur in small headwater streams, often upstream from impassable physical barriers.

Resilience - The potential for recovery if a loss occurs.

Riffle - A shallow gravel area of a stream that is characterized by increased velocities and gradients, and is the predominate stream area used by salmon for spawning.

Riparian - Referring to the transition area between aquatic and terrestrial ecosystems. The riparian *zone* includes the channel migration zone and the vegetation directly adjacent to the CMZ that influence channel habitat through alteration of microclimate or input of LWD. The riparian *buffer* refers to the strip of vegetation left adjacent to rivers, streams, estuaries, and coastlines following human alterations (harvest or development). Riparian *function* refers to LWD-recruitment and stream-shading functions provided by riparian vegetation, which if removed, result in a change in the physical, chemical, or biological properties to the waterbody.

Risk assessment - Evaluating the probability of an action having a negative impact that is not within prescribed limits or acceptable bounds.

River mile (RM) - A statute mile measured along the center line of a river. River mile measurements start at the stream mouth (RM 0.0)..

Riverine - Referring to the entire river network, including tributaries, side channels, sloughs, intermittent streams, etc.

Run - The sum of stocks of a single salmonid species which migrates to a particular region, river, or stream of origin at a particular season.

Run Reconstruction - A post season accounting of all salmon harvest and escapement for each individual stock or management unit.

Salmon and Steelhead Habitat Inventory and Assessment Project (SSHIAP) - A state/tribal cooperative program to gather, analyze, and inventory data on the amount and condition of salmon and steelhead habitat.

Salmon and Steelhead Stock Inventory (SASSI) - A cooperative program by the Washington Department of Fish and Wildlife, and Washington Treaty Indian Tribes to inventory and rate the status of salmon and steelhead stocks on a recurring basis. The 1993 SASSI identified salmonid stocks and their status with information on stock origin and history and provided descriptions of the factors which affect stock status. The inventory process is no longer confined to just salmon and steelhead, and now encompasses several additional salmonid species. Future inventories will be titled Salmonid Stock Inventory (SaSI) to accommodate the inclusion of anadromous trout species.

Salmonid - Any member of the taxonomic family Salmonidae, which includes all species of salmon, trout, char, whitefish, and grayling.

Salmon Recovery Office (SRO) - Also called the Governor's Salmon Recovery Office, it is a State work group that coordinates statewide efforts dealing with all aspects of salmon recovery.

Saltmarsh - A grass-dominated wetland periodically inundated by saltwater.

Salvage - The removal of snags, downed logs, windthrow, or dead and dying material.

Scour chain - A device that is inserted into a gravel streambed and used to measure scour or streambed instability.

Selective fishery - A fishery that allows the release of non-targeted fish stocks/runs, including unmarked fish of the same species.

Self-sustaining population - A population of salmonids that exists in sufficient numbers to replace itself through time without supplementation with hatchery fish. It does not necessarily produce surplus fish for harvest.

Set gillnet - A gillnet which is anchored, tied, staked, laid in part on shore, or whose lead line is so heavily weighted that it cannot drift (WAC 220-16-095).

Shoreline Management Act - A Washington State law which establishes a process for coordinated planning to protect shorelines and public uses of shorelines. The act requires that the Department of Ecology oversee and advise local governments in shoreline planning. Local governments develop shoreline erosion management standards and permit structural and non-structural erosion control measures adjacent to shorelines and large waterbodies.

Sinuous - Bending, winding, or curving.

Site potential tree height (SPTH) - The average maximum height attained by a tree within a specified time period, given particular site conditions. For the purposes of this plan, this period is 200-300 years, or the time necessary for a riparian forest to reach full maturity.

Skiff gillnet - A gillnet of single web construction with floats along the corkline sufficient to float the net. A skiff gillnet may be laid in part on shore, but may not be anchored, tied, or staked, nor have a lead line so heavily weighted that the net cannot drift (WAC 220-16-046).

Smolt - A juvenile anadromous salmonid which is undergoing the physiological and behavioral changes required to migrate from fresh water to salt water.

Stock - The fish spawning in a particular lake or stream(s) at a particular season, which to a substantial degree do not interbreed with any group spawning in a different place, or in the same place at a different season.

Stock origin - The genetic history of a stock.

Stock status - The current condition of a stock, which may be based on escapement, run-size, survival, or fitness level.

Subestuary - The area at the mouth of a river tributary to Hood Canal and the eastern Strait of Juan de Fuca that includes the delta, tidal channels, mudflats, marshes, and eelgrass meadows. See "estuarine landscape".

Substantial risk of extinction guideline - Judgements regarding the acceptability of risks assumed through measures proposed in this plan may be based on whether the target population is believed to be in substantial danger of extinction within the next 36 years. This duration is derived from an average summer chum life span of 3.6 years applied to a 10 generation risk standard set forth by the Federal Court in judging extinction risk (Oregon Natural Resources Council v. NMFS and the State of Oregon 1998).

Subtidal zone - Shallow-water areas below mean low water.

Summer chum salmon - The earliest returning chum salmon (*Onchorynchus keta*) stocks in the Hood Canal and Strait of Juan de Fuca region. Summer chum salmon return from the ocean from mid-August through October, and spawn predominately in September and October. These stocks have been shown to be genetically distinct from fall and winter timed chum salmon.

Supplementation - The use of artificial propagation to maintain or increase natural production while maintaining the long-term fitness of the target population, and keeping the ecological and genetic impacts to non-target populations within specified biological limits.

Targeted fishery - A harvest strategy designed to catch a specific group of fish.

Terminal fishing (management) area - Marine waters near the ultimate freshwater destination of specific salmonid stocks (or groups of stocks) where they have separated from fish returning to other regions. These areas for summer chum salmon include all marine waters of Hood Canal, and Discovery, Sequim, and Dungeness bays.

Thalweg - A line connecting the deepest channel sections along a stream. In fisheries work "thalweg" commonly is used to identify the deepest portion of the channel along a stream.

Timber Fish and Wildlife (TFW) - A coalition of the timber industry, state and local governments, tribes, and recreational and environmental groups that addresses the interactions of timber management activities and fish.

Total population size (*N*) - The number of spawners cumulated over a number of years equivalent to one generation. For summer chum salmon, total population size can be calculated; N = Average escapement times 3.6 (generation length).

Trend - The directional change in a time-series data set.

Tribal Fish Ticket data base (TFT) - Maintained by the NWIFC.

Tributary - A stream feeding, joining or flowing into a larger stream, a lake, or saltwater.

Unknown stock - A stock for which there is insufficient information to identify stock origin or stock status with confidence.

U.S. Fish and Wildlife Service (USFWS) - A branch of the federal Department of Interior whose responsibilities include administration of the endangered species act as it affects non-anadromous fish and steelhead, wildlife and plants.

U.S. Forest Service (USFS) - A branch of the Department of Agriculture.

U.S. v. Washington - A 1974 Federal Court Decision that affirmed the fishing rights of western Washington Treaty Indians Tribes. Commonly referred to as the "Boldt Decision".

Viable population - A population in a state that maintains its vigor and its potential for evolutionary change.

Washington Catch Record Card Area - A WDFW sport salmon harvest reporting system that uses standard catch areas (identified by number).

Washington Commercial Catch Reporting Area - A WDFW commercial salmon harvest reporting system that uses standard catch areas (identified by number).

Washington Department of Fish and Wildlife (WDFW) - Created by the merger of the Washington Department of Fisheries (WDF) and the Washington Department of Wildlife (WDW) in 1994.

Water resource inventory area (WRIA) - Watershed-based planning unit, defined by the Washington State Department of Ecology. WRIAs are determined by drainages and common water bodies.

Watershed - The region drained by or contributing water to a stream, lake or other body of water, physically separated from other watersheds by a drainage divide..

Watershed Administrative Unit (WAU) - The State of Washington has been divided into approximately 800 watersheds called Watershed Administrative Units, the boundaries of which are described in the Department of Natural Resources Watershed Administrative Unit Map. These are the basic geographic units for the process of watershed analysis administered by the Department of Natural Resources.

Watershed Analysis - A systematic procedure for characterizing watershed and ecological processes to provide a basis for resource management planning.

Western Washington Treaty Indian Tribes (WWTIT) - Indian tribes located west of the Cascade Crest that have been recognized by the United States government, with usual and accustomed fishing grounds, and whose fishing rights were reserved under a treaty and have been affirmed by a federal court.

Wetland - An area that is inundated or saturated by surface or ground water at a frequency and duration sufficient to naturally support distinct soil and vegetation types. Wetlands interact with surface and ground waters and can regulate stream flow, moderating extreme winter peak and summer low flow conditions.

Wild Olympic Salmon (WOS) - Based in Chimacum, Washington, WOS is an independent, private organization dedicated to the perpetuation and recovery of Washington salmonid populations. The group is volunteer-based, and is active in salmonid enhancement and habitat improvement projects throughout the Strait of Juan de Fuca region. The group operates the Salmon Creek summer chum supplementation and Chimacum Creek reintroduction programs co-operatively with North Olympic Salmon Coalition and WDFW.

Wild stock - A stock that is sustained by natural spawning and rearing in the natural habitat, regardless of parentage (includes native).

Wild Stock Restoration Initiative (WSRI) - A cooperative program between the state and western Washington Indian tribes that is intended to maintain and restore healthy salmon ad steelhead stocks and habitats.

Within-stock diversity - The overall genetic variability among individuals of a single population or stock.

Acronyms and Abbreviations

AUC - Area Under the Curve.
BBC - Big Beef Creek.
BCR - Base Conservation Regime.
BMP - Best Management Practices.
CDFO - Canadian Department of Fisheries and Oceans
cfs - Cubic feet per second.
CMZ - Coastal Management Zone.
COE - U.S. Army Corps of Engineers.
CRC - Catch Record Card.
CREP - Washington State Conservation Enhancement Program**.**
CTED - Washington State Department of Community, Trade and Economic Development.
CWT - Coded Wire Tag.
dbh - Diameter at breast height.
DNA - Deoxyribonucleic acid.
DNR - Washington State Department of Natural Resources.
DO - Dissolved oxygen.
DOE - Washington State Department of Ecology.
DOT - Washington State Department of Transportation.
EDF - Escapement Distribution Flag.
EHB - Engrossed House Bill (Washington State Legislature).

ELJ - Engineered logjam.
ENSO - El Niño-Southern Oscillation.
EPA - U.S. Environmental Protection Agency.
ESA - Endangered Species Act.
ESU - Evolutionarily Significant Unit.
FAO/UN - Food and Agriculture Organization of the United Nations.
FEMA - Federal Emergency Management Agency.
FEMAT - Forest Ecosystem Management Assessment Team.
FERC - Federal Energy Regulatory Commission.
fpp - fish per pound.
fl - Fork length.
GIS - Geographic Information System.
GSI - Genetic Stock Identification.
HB - House Bill (Washington State Legislature).
HC - Hood Canal .
HCCC - Hood Canal Coordinating Council.
HCP - Habitat Conservation Plan.
HCPEP - Hood Canal Production and Evaluation Program.
HCSEG - Hood Canal Salmon Enhancement Group.
HCSMP - Hood Canal Salmon Management Plan.
HC-SJF - Hood Canal and Strait of Juan de Fuca.
HCWCP - Hood Canal Wild Coho Salmon Evaluation and Rehabilitation program.
HPA - Hydraulic Project Approval.
IFIM - Instream Flow Incremental Methodology.
JCL - Jimmycomelately Creek.
JNRC - Joint Natural Resources Cabinet.
LLTK - Long Live The Kings.
LWD - Large Woody Debris.
MEF - Minimum Escapement Flag.
MHCLS - Microcomputer Historic Catch and Landing Summary.
MHHW - Mean higher high water.
MLLW - Mean lower low water.
MSY - Maximum Sustained Yield.
MU - Management Unit.
MVP - Minimum viable population.
N - Total population size.
NA - Not applicable.
N_e - Effective population size.
NFH - National Fish Hatchery.
NMFS - National Marine Fisheries Service.
NOF - North of Falcon.
NOR - Natural Origin Recruit.
NOSC - North Olympic Salmon Coalition.
NPDES - National Pollution Discharge Elimination System.

NPS - U.S. National Park Service.
NRC - National Research Council.
NRR - Natural Return Rate.
NS - Natural spawners.
NWIFC - Northwest Indian Fisheries Commission.
pcs/m - Pieces per meter.
PDO - Pacific Decadal Oscillation.
PFMC - Pacific Fisheries Management Commission.
PNPTC - Point-No-Point Treaty Council.
PNPTT - Point-No-Point Treaty Tribes.
PNW - Pacific Northwest.
PSC - Pacific Salmon Commission.
PSCRBT - Puget Sound Cooperative River Basin Team.
PSMFC - Pacific Salmon Marine Fisheries Commission.
PSSFI - Puget Sound Stream Flow Index.
PSSMP - Puget Sound Salmon Management Plan.
PST - Pacific Salmon Treaty.
PSWQAT - Puget Sound Water Quality Action Team.
PUD - Public Utility District.
PVA - Population Viability Analysis.
QNFH - Quilcene National Fish Hatchery.
RCW - Revised Code of Washington.
RM - River Mile.
RSI - Remote Site Incubator.
SASSI - Salmon and Steelhead Stock Inventory.
SEPA - State Environmental Policy Act.
SJF - Strait of Juan de Fuca.
SPTH - Site potential tree height.
SR - State Route highway.
SRO - Governor's Salmon recovery Office.
SSHIAP - Salmon and Steelhead Habitat Inventory and Assessment Project.
STC - Simpson Timber Company.
TFT - Tribal Fish Ticket data base.
TFW - Timber Fish and Wildlife.
USFS - U.S. Forest Service.
USFWS - U.S. Fish and Wildlife Service.
USDA - U.S. Department of Agriculture.
USDI - U.S. Department of Interior.
USGS - U.S. Geological Survey.
UW - University of Washington.
WAC - Washington Administrative Code.
WAU - Watershed Administrative Unit.
WCVI - West Coast Vancouver Island.
WDF - Washington Department of Fisheries.

WFPB - Washington Forest Practices Board.
WDFW - Washington Department of Fish and Wildlife.
WDW - Washington Department of Wildlife.
WOS - Wild Olympic Salmon
WRIA - Water Resource Inventory Area.
WSRI - Wild Stock Restoration Initiative.
WWTIT - Western Washington Treaty Indian Tribes.